Safety Education
in
Industrial School Shops

A Study of Accidents in School Shops,
Their Causes, and Recommendations
for Approved Procedures

Bulletin 332

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DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg 1938

FOREWORD

Facts are needed if we are to find solutions to the accident hazards in promoting safety education. This report represents a carefully planned and executed study in an attempt to secure information regarding accident injuries in the school shops throughout the Commonwealth of Pennsylvania for a period of one year. The recommendations are based on factual information and successful solutions to the problems gained through experience.

The increasing interest in safety education of all types is indicative of the present-day attitude of leaders in school, business, industry, and other groups. The success of the Student Patrol has been so remarkable that it tends to encourage and extend a positive program of safety education to other phases of the school work. Planned programs of safety in industry and in school shops are yielding valuable results in the reduction of the number of accidents and in making the workers safety conscious.

This bulletin was prepared by Dr. Paul L. Cressman, Director of the Bureau of Instruction. Superintendents of schools, directors of vocational education, and shop teachers cooperated in furnishing the reports of accidents occurring in the school shops of Pennsylvania.

The material is designed to be helpful to teachers now engaged in shop work and to students preparing to be industrial teachers. The industrial teacher holds a key position in the development of safety education for future workers in industry.

LESTER K. ADE

Superintendent of Public Instruction

December, 1938

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HOW TO USE THIS BULLETIN

The materials of the bulletin are arranged in an order expected in the study of a problem for the purpose of seeking a solution. Because the materials are so arranged, the following suggestions as to how to use the bulletin will be helpful.

1. Make everyday application of the practical suggestions for safety as outlined in
   Chapter VII. Recommendation for a Safety Education Program.

2. Make your school shop students safety conscious:
   a. Students should tabulate their own accident injury data as outlined in
      Chapter V. The Findings of This Study.
      Chapter VI. The Summary, Conclusions, and Implications.
   b. Each school or class should keep its own accident injury records. A helpful form for this purpose is found in the study and definitions of severity of injury in
      Chapter IV. The Procedure and Method Used in This Study.
   c. Schools should inquire how other schools keep records. Suggestions are outlined very briefly in
      Chapter III. Important Studies Previously Made.
   d. Instructor and students should practice the standards set up in
      Chapter VII. Recommendation for a Safety Education Program.

3. Make further research study.
   Refer to page 54. Future Study Suggested.
   For research purposes the materials of this bulletin may be studied in the following order:
   Chapter II. The Problem.
   Chapter III. Important Studies Previously Made.
   Chapter IV. The Procedure and Methods Used in This Study.
   Chapter V. The Findings of This Study.
   Chapter VI. Summary, Conclusions and Implications.

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Chapter I

The Introduction

SAFETY EDUCATION—A PUBLIC CONCERN

Safety is one of the important problems of living together in a well-organized society, if not actually a concern of keeping physically alive. This problem concerns everyone in this complex age.

According to the United States Census Bureau more deaths are caused by accidents than by any disease. Figures of accidents and injuries appear frequently in newspapers, magazines, bulletins, and books. They all tend to impress one with the magnitude of the problem. In fact, accident figures in America are in such proportions as to warrant comparison with deaths and injuries occurring to our American soldiers during the World War for a similar period.

The importance of this subject cannot be over-estimated from an economic standpoint. American concerns spend many millions of dollars annually to prevent accidents in their industries.

In 1928, more than $15,000,000 was paid in Pennsylvania in compensation insurance for industrial accidents. It is usually estimated that the compensation represents about one-fifth of the total cost. If that be true, then Pennsylvania lost $75,000,000 through accidents in industry in one year.

While loss in "cold" cash always has been a factor in emphasizing the importance of the problem, it is felt that society has, as a whole, become more sensitized to the importance of the human side of the problem. An increasing concern has been manifested in avoiding or reducing human losses, and for relieving the misery and wretchedness of suffering. This, too, has had a tendency toward increasing production and improving the relationship between the employer and the employe. All this tended to pave the way for the safety organizations which began as early as 1905, and spread rapidly.

Employers soon began to ask, What was the cause of the accident? Who was at fault? and How could it have been avoided?

Guarding of dangerous places noted from accident reports and studies was emphasized. Men in industry in early days, as well as some few shop teachers today, charged the cause of many of the accidents to carelessness. Fortunately, neither safety men in industry nor leading safety leaders in schools have been willing to accept this as a cause. Carelessness reflects an improper attitude toward safety. Somehow safety education was not effective, and the question to be answered was—Why was it not effective?

Students of this problem made a deeper search for causes of accidents which take us beyond the mechanical elements and the common human elements. A study of the health, worry, strain, and the physical condition of the worker was undertaken in numerous places. As an example of this, the National Research Council, conducting an

inquiry into the "human equation" as a cause of automobile accidents, discovered that many people who think they are properly equipped for safe driving actually have serious physical impairments they know nothing about. Dr. Alvah R. Lauer, in charge of the investigation, found that particularly in matters of vision there were many unsuspected deficiencies commonly ignored.

Among these, frequent causes of accidents were found to be improper depth perception, contracted field of vision, ocular dominance (one eye stronger than the other), color blindness, and weak glare resistance. Other unusual causes are weakness of grip in steering and susceptibility to shock from sudden noises. Doctor Lauer has invented unique mechanical devices to test these factors, and he hopes soon to have a completely accurate method of determining whether a driver can meet standard requirements for safety.

There is great need for such methods. In 1932, more than 1,000,000 automobiles were involved in accidents throughout the country, 29,000 persons were killed, and 904,800 injured. Of this appalling toll, a large percentage undoubtedly was due to these very deficiencies Doctor Lauer has discovered. His testing devices, if they decrease this number, will be "preventive medicine" of the first importance.

Studies in industry indicate possibilities for further research somewhat along the same line referred to in the foregoing paragraph. School officials and shop teachers will do well to study this problem thoroughly. If this is done in a careful, consistent, and intelligent manner, it is bound to yield dividends in the form of reduction of accidents in school shops and also in the preparation and training of safety-minded adult workers.

Something can be done about the problem of reducing accidents. It has been demonstrated, it is being demonstrated, and the prospects are exceedingly hopeful of even better days ahead when society adjusts itslf better to this machine age.

SAFETY EDUCATION SUCCEEDS

The National Safety Council in its 1933 edition of "Accident Facts," shows that accidents resulting in injury and death occur much less frequently to students engaged in school activities than to those engaged in non-school activities. This also includes injuries and fatalities in athletics.

There is considerable evidence that improvement is noted as a result of definite safety instruction, and through the furnishing of safety equipment. An example of this is noted by O. H. Turner, Superintendent of the David Rankin, Jr. School of Mechanical Trades, St. Louis, Missouri, in a report of a study on eye injury cases:

Year	Eye Cases
1926-27	16
1927-28*	5
1928-29	4
1929-30	8
1930-31	5

*Goggles were provided students in machine shop, plumbing shop, and automobile shop.

Superintendent Turner makes the following comment in connection with this study:[1]

"It is not always an easy matter to convince shop instructors that all of the measures advocated by safety experts are necessary. And some of these measures may be extreme and unreasonable. But when many of the largest and most successful industrial organizations adopt them, the instructors are more inclined to give heed. A visit to the Pullman Company plant in St. Louis by our machine-shop teachers a few years ago thoroughly convinced them that we should make a more general use of goggles in our school shops. This company requires all its employes to wear goggles at all times while in their shops whether actually working or not. Even visitors passing through the shops are required to wear goggles."

We should be further encouraged in a safety education program when we note the success of the schoolboy patrols. Reports indicate that accident deaths in the five and fourteen age group decreased substantially in 1932 and in 1933, while those under five years of age remained the same. Credit for this reduction is ascribed to safety education and safety organizations such as schoolboy patrols.

The teachers in New York City are given a twenty-week course in accident prevention, designed to acquaint them with the facts about the accident situation in their city, and to suggest various means of teaching safety in the classroom. According to a statement in "The Forecast," the sponsors of the course are the school system, the police department, the homes, the parents' associations, and all others interested in street safety.

The police are constantly trying to curb the dangerous practice of stealing rides or hitching; in many cases the young offenders are taken in charge by welfare officers of the precincts, who notify the parents and seek their help in discouraging this practice. Every effort is being made to interest the children in wholesome recreational activities as an antidote to the kind of play that may lead to accidents.

The accident-reporting system is the basis of the prevention work. If the accident is reported, investigations can be made so that preventive measures can be taken.

SAFETY EDUCATION OPPORTUNITIES

With the enrollment of more than 1,000,000 persons in vocational classes in America, and with the millions of boys in industrial arts classes in the junior high school grades—what a responsibility! What a challenge! What an opportunity is ours as shop teachers to make America safety-minded!

In the new day that is dawning for education, safety education will play an important part in helping the individual to make his adjustments to the environment of things, peoples, institutions, and ideals. Since it is closely associated with life itself, just as is citizenship, character education, and health, it deserves an important place in the modern curriculum.

If one follows a plan for promoting the positive aspects of safety teaching, he will not merely try to avoid accidents, but will try to

[1] An unpublished manuscript.

fulfill the real purposes of living. In developing a safety program for industrial students in junior high schools, senior high schools, and in trade schools, possibilities present themselves for developing a positive social point of view in safety toward all individuals in society.

With safety devices on machinery being constantly improved and perfected, and with a very definite attitude on the part of industry to deal very directly with this safety problem, it would seem that the school shops have a most fertile field in which to make a genuine contribution by preparing future safety-conscious workers. This can be done if the boys in the school shops practice safety, work under safe conditions, and are familiar with the best safety methods. This, in turn, can be accomplished if the teachers of these boys measure up to all the standards set up for the boys themselves. It becomes a problem of school administrators, chiefly the directors of industrial education, and the teacher-trainers, to meet this challenge of providing "safety minded" instructors in all school shops. Fortunately, sincere efforts are being made in this direction.

THE PENNSYLVANIA SCHOOL-SHOP ACCIDENT-INJURY STUDY

This Pennsylvania study of school-shop accidents covers a period of one school year. All the districts offering trade and industrial arts education throughout the State have been invited to participate. The response has been very encouraging. The returns are believed to be truly representative of conditions in the State as a whole. When one carefully scrutinizes these returns, it is believed that the source material for this study is valid and reliable.

This study has stimulated districts to set up rules and regulations for accident prevention, for first aid, and for reporting accidents regularly. Pamphlets, some of which are a few pages in length, and others that are very complete, are being issued by local school districts as one of several effective means of education in safety.

School equipment, in many districts, has been rechecked by safety experts during the past year to see how it measures up to safety specifications of the most approved types. State factory inspectors have been invited by school authorities to review local school equipment to see if this equipment conforms with the latest safety standards.

SUMMARY

Safety education is of vital concern to everyone. Accidents cover as broad a field as the activities in which man engages. Safety education is rendering a real contribution to the social, economic, and humanitarian aspects of life.

There are many illustrations of satisfactory results produced through safety education. The school shops have a real opportunity to extend safety education by reducing accidents in the school shops, and by producing safety-conscious workers.

The Pennsylvania study of school-shop accidents is designed to extend a program of safety education in the school-shops of the Commonwealth.

Chapter II

The Problem

The problem of safety education and safety practices is essentially one of conserving human resources. It concerns itself with ways and means of preserving America's most valuable heritage—the health and welfare of its young and adult people.

It is well known that attention has been directed to this problem particularly during the past quarter of a century, yet statistics indicate that the accident rate in America is the highest among the civilized nations.[1]

We have reason to believe that much more must be done to reduce the hazards for those employed in industry and those preparing to enter industry.

A PENNSYLVANIA STUDY

For practical purposes it seemed wise to limit this study to accidents in school shops in Pennsylvania for a period of one year. The study was designed:

1. To reduce accidents in school shops.
2. To produce safety-conscious workers in school and industry.
3. To emphasize social responsibility for fellow-workers in school and industry.
4. To contribute to an improvement in reporting accidents which is essential to secure valid and reliable raw data.
5. To analyze the data; draw conclusions, and make recommendations for a safety education program based upon the findings.

ACCIDENTS DEFINED

Many accident definitions[2] can be found by reviewing the safety literature. In industry reportable accidents are usually based on a lost time factor. The school-shop accident definitions are more exacting, not determined by lost time but by bodily injury. In accordance with the definitions of a school-shop injury and also in order to emphasize the importance of giving attention to the most minor injury, the following definition was prepared for this study:

Every mishap that causes injury to the body or a member of the body should be considered an accident injury.

PRESENT CONDITIONS

The present conditions so far as the problem of safety is concerned, are considered briefly under the following headings:

The Boy
The Shop Teacher
The School District Officials
Teacher-Preparation
Men in Industry
Manufacturers of Equipment
The State Departments
The Public Concerned with Problem

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[1] C. B. Auel, in United States Bureau of Labor *Bulletin 429*, p. 108.
[2] On page 28 will be found a number of the more important definitions of accidents.

The Boy. The boy comes to the school shop and usually is anxious to do things. He wants to start at once and frequently would like to complete the project in one period. In fact, he would like to work in the shop for a longer period of time, but the bell rings and classes change according to the school schedule. How does this affect safety practices? He is in a hurry. The time is too short to do all he wants to do. Does he fasten his material securely before he starts work, or does he frequently attempt to hold the material on which he is working with one hand? Adjusting guards and wearing goggles seem to be an added difficulty.

In some few cases he observes others operate machines without guards in place. Occasionally he sees others take chances. What effect does this have on him? Can he be taught to work safely for his own sake, and also protect others working with him or observing him?

What effect does his shop experience have on him in preparing him to be a safe worker in industry, and a safety-minded member of society?

The Shop Teacher. It should be said to the credit of the shop teachers that they are emphasizing safety education and practice it in an ever-increasing degree. This increase is probably about at the same rate that working men in industry reflect improvement in safe practices, and all this is probably the result of the emphasis given safety in recent years.

Many shop teachers reflect safety in practice in all of their work. Their students learn from example more than from precept. This is a most effective way of teaching. They also devote time to teaching safe ways of doing things, such as, what precautions to take, and how to cooperate in a school group in the interest of safety.

Unfortunately, even now one can hear a few shop teachers make such remarks as these: That guard is more nuisance than it is worth; When I worked in industry we would not use guards; Every man should carry the sign of his trade—look at this stub of a finger; In the teacher-training school the shop teachers did not require us to use guards nor take safety precautions.

Fortunately these teachers are becoming fewer in number, but what are we going to do with those of this type who remain even a year longer? How great will be the effect of their unsafe attitude and unsafe practices on society? How great will be the harvest? What can be done about it?

The shop teacher who is continuing his professional education has taken the attitude of a research worker. He has set up a plan for keeping records of shop accidents to determine causes of accidents and points of danger for the purpose of seeking remedies. We need to encourage all shop teachers to study this problem from this angle.

Then, too, teachers are frequently given large classes. It is not infrequent that they have more students than their equipment and facilities provide locations. This creates a real problem even for the best teachers. The teacher is also confronted with many other problems, such as, seeing that all mechanical safety devices are con-

stantly in place, that the light is adequate, that there is good housekeeping, and, above all, that students are instructed in safe ways of doing things.

The School District Officials. The board of education, the superintendent of schools, the assistant superintendent, the director of vocational education, and the principal have in recent years become interested in all phases of safety education. Each year records an increase in the ranks of school officials who are interested in setting up programs of safety education. They are no longer content to let safety education be incidental to the rest of the curriculum. The plans[3] followed in various school districts differ considerably, but at this time that is not of major importance. The important part is—does the plan work and does the staff actually work seriously at this task? Is the district getting results?

Since safety lends itself readily to studies, tables, tabulation, etc., and because of annoying school accident situations that have developed in almost every community, school officials are now asking that reports of all accidents be sent to the central office. In an increasing number of districts the data is being tabulated and comparisons are being made between teachers, schools, and previous yearly records. There is a gradual acceptance of a common form for reporting. A number of districts have adopted the form used to secure the information for this study. Fortunately, the persons writing on safety and developing safety materials, are almost, without exception, willing and pleased to have others use their forms and materials in whole or in part. They do this for the cause of safety education.

The school districts have the problem of purchasing properly guarded equipment and having it installed properly. The standards of proper guards for machines ought at least to meet the standards of Departments of Labor and Industry of the respective states. School officials will do well to consult representatives of Labor and Industry Departments to be certain their equipment measures up to the safety standards in every respect.

School officials need also to inquire into the lighting, the arrangement of equipment, and auxiliary rooms which contribute to safe situations. They also need to be concerned with the physical conditions of the students, such as, health, sight, etc.

School shops are exceedingly dangerous places to over-crowd[4] with students.

Teacher-Preparation. The opportunity and responsibility that teacher-preparation institutions have in promoting safety education can securely be over-estimated. Fortunately, this opportunity is being embraced by all of these institutions. The complete cooperation of all the members of the faculties in these colleges and universities is needed. At this time this complete cooperation of all members in all faculties is not realized. What steps should be taken, particularly with institutions preparing industrial arts teachers, so that they will

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[3]Idabelle Stevenson, "General Account of Prevalent Types of Administration." National Society for the Study of Education, The Present Status of Safety Education. Part I, Twenty-fifth Yearbook. Bloomington: Public School Publishing Company, 1926.

[4]By over-crowding is meant more students than there is equipment providing for a working location for each boy, and also more students than the teacher can instruct safely.

lead in the most modern and approved practices of safety?

The colleges and universities preparing tradesmen to become trade teachers have an even more difficult task. The tradesmen have learned their trades in industry; habits of work and safety practices, or the lack of them, are fixed to a marked degree. How can all these prospective trade teachers be induced to adopt the most improved safety devices and approved safety practices?

The teacher preparation, on both an industrial arts and vocational basis, has demonstrated that prospective teachers, and those taking training while in service, will accept the challenge that safety education presents.

Men in Industry. In every age we have had the safe and unsafe worker. It must be conceded that because of improved machines built to eliminate accident hazard, and equipped with safety guards, and because of the safety education program conducted in industry today, the workers are much more safety-minded than they were a decade or more ago.

The tradesmen from industry who qualified to teach, in many cases, reflect an attitude toward safety which many of the tradesmen held in their day when they worked in industry, rather than the attitude of modern industrial workers. This has been a problem with which alert directors of vocational education have been dealing during the past few years with reasonably gratifying results. More needs to be done along this same line so that one generation of workers does not hinder another generation in making progress, growth, and improvement by insisting that their way of doing things is the best way or the only way. An attitude of alertness to discover new and improved ways of doing things, particularly from a safety standpoint, should continue to be cultivated.

The industrial teachers of today can profit greatly by keeping in touch with safety programs and practices in industry. Industry is concerned with safety education. It is, however, even more concerned with the elimination of the accident hazards. This is apparent particularly in the engineering revision that has been taking place in equipment.

Manufacturers of Equipment. Machines today are designed not alone with labor-saving devices but also with a view of eliminating hazards. Belts, gears, wheels, etc., are enclosed. The square head cutter on the jointer gave way to the cylinder-head cutter, thus reducing at least the degree of the damage in the event of accident. The paper cutter of modern type requires both hands on controls for operating to insure complete safety for the fingers of the operator. All groups look to the engineer in industry to continue to make machines practically "fool-proof" so far as hazards are concerned. He has done much toward this end. There is much more to be done.

The State Departments. The state Departments of Labor and Industry in the several states have set up safety standards and regulations. They have been a very potent force in the safety movement.

The regulations governing guards and safety measures generally, were drawn up cooperatively with representatives of industry—employers and employes.

The regulations were designed to correct hazards or unwise practices. These hazards were noted from studies made from accident reports sent to these Departments.

One of the problems in this study was to see how many school districts, without previous notice, would willingly and graciously cooperate in a state-wide study in school-shop accidents. In other words, has a stage been reached when teachers, directors, and school authorities generally, would be willing to report all school-shop accidents to the State Department of Public Instruction for purposes of tabulation and study? Might such continual study tend to promote safety practice and safety education in school shops generally?

While this study was limited in that not all the schools within the State of Pennsylvania participated, the distribution as to size of districts, size of schools, and geographical distribution was such as to give a good picture of the situation as it exists today in Pennsylvania.

One phase of this problem which has not been satisfactorily worked out in industry generally, nor in schools, is a comparative study of exposure per injury.[5] Many isolated attempts have been made to secure exposure information with a fair degree of success. Ultimately, it must be secured, if a true index of the accident record is to be made available.

An article appeared in the newspapers indicating that in March, 1933, a certain state had the lowest accident record in its history. If that report would have included a study showing exposure, it would have revealed that the month of March, 1933, had the lowest record in employment in that state for generations, and in comparison to the number of men working, or the exposure compared with the accident record, the month of March, 1933, was an exceedingly bad record for accidents.

This feature was included in the Pennsylvania Study for the purpose of calling attention to the need of this element in a study. The figures are available in some few schools. It was, however, too much to hope for at this stage to have all schools figure out carefully the frequency rate and severity rate. This will be done, however, within a few years. Progress in safety statistics demand it in order to secure a true picture of conditions. When its importance is realized it will be cheerfully forth-coming.

The Public Concerned with Problem. The problem of safety concerns everyone. We are all interested in conserving human life and in avoiding painful experiences, waste, and economic loss. Everyone is concerned with finding remedies. The schools have a remarkable opportunity to make a contribution in the interest of safety. The

[5]This is usually referred to as: Frequency rate = Lost time accidents per million man hours worked. Severity rate = Number of days lost per thousand man hours worked.

public wants them to make this contribution and the schools are rapidly adjusting themselves to measure up to this expectation.

SUMMARIZING THE PROBLEM

Human resources can be conserved through reducing school shop accidents, through producing safety-conscious workers in school and industry, and through developing a social responsibility for fellow-workers. To this end it was deemed advisable:

1. To make a critical study of the literature of accident prevention in industry and in schools supplemented by conferences with teachers, administrators, and safety leaders in industry and other associations.
2. To develop a carefully planned report form to be used in gathering raw data.
3. To set up a procedure through the State Department of Public Instruction for securing essential data typical of conditions throughout the State which would be objective, valid, and reliable.
4. To analyze the data and make recommendations based upon the findings.

Chapter III

Important Studies Previously Made

The literature on safety education clearly indicates an increasing interest in this subject. This interest in safety is just beginning to manifest itself in a rather extensive, although generally very incomplete manner. It appears in a marked degree in the form of filing reports of accidents and the tabulation of the same, in other words accident studies. Accidents and their prevention readily lend themselves to statistical study. Most of these studies, generally in mimeographed form, have been made within a certain school organization or cover a city school system.

Safety manuals and magazine articles are becoming quite numerous on some phase of the subject of safety. The manuals are prepared by school districts, industrial concerns, insurance companies, and the National Safety Council.

The National Safety Council is the most thoroughly representative national organization in the field of safety. This association has a large membership of employers, public officials, organizations, and individual membership. This council concerns itself with various phases of safety, in the home, in the industry, and the public places. Their studies and publications are numerous as will be noted in the bibliography.

The State Departments of Labor and Industry and Highway Departments also have made extensive accident studies in industry and highways respectively.

The National Society for the Study of Education undertook a study on "The Present Status of Safety Education" in 1926, and published the "Twenty-fifth Yearbook." This report is quite complete and represents a real contribution to the cause of safety education. It is a collection of a number of studies and papers prepared on the general subject of safety or parts of it.

FEATURES OF INTEREST IN PREVIOUS STUDIES

The following studies made in Essex County, N. J., State of Iowa, Williamsport, Philadelphia, Hershey, Pittsburgh, and Lancaster, Pa., contain particular features of interest. A brief presentation of these features follows:

The Essex County Vocational School Study

The Essex County Vocational School Study[1] was made by Max P. Henig, an instructor in that school. The accident study was made for the purpose of discovering hazards which in turn would be of importance in the construction of a curriculum for industrial accident prevention. In part, he found that no less than 208 reportable accidents occurred between September of 1919 and June of 1922. This was, incidentally, a good rather than a bad record. During those years a complete safety program was developed and put into operation. For the purposes of this study, Dr. Henig counted every mishap that resulted in an injury that required treatment, and every injury

[1]Max P. Henig, *Safety Education in the Vocational School*, New York: National Bureau of Casualty and Surety Underwriters, 1928.

that presented the possibility of infection received treatment and thus was counted. Even the merest cut was included.

Here is a compilation showing the accidents used by Henig in his study:[2]

Number of Accidents by Cause—September 1919, to June 1922

	Departments					
	Auto Repair	Car-pentry	Draft-ing	Elec-trical	Mach-ine	Total
Hand Tools	17	33	0	14	8	72
Machines	0	20	0	3	13	36
Handling Material	14	8	0	2	7	31
Scuffling, Horseplay, etc.	3	4	2	3	2	14
Struck Objects	0	10	0	3	0	13
Burns	0	0	0	5	2	7
Handling Chips	0	0	0	0	6	6
Struck by Material	0	2	0	0	2	4
Cranking Motor	4	0	0	0	0	4
Falls	0	2	0	0	0	2
Miscellaneous	9	2	3	2	3	19
	47	81	5	32	43	208

The Iowa Study

The Iowa Study of accidents was made by Wayne M. Judy.[3] The study covers 249 industrial arts shops in Iowa. This study indicates a willingness on the part of the industrial arts teachers to cooperate in a safety study on a state-wide basis. While this study covers the location, causes and nature of the accidents and injuries, it also inquired into the methods employed in advising safety education.

Accident Analysis of 249 Industrial Arts Shops of Iowa

The total number of accidents requiring medical treatment.....726
The number of accidents treated by a physician.....113
The number that resulted in the loss of any part of the body..... 18
The number that resulted in the loss of one or both eyes..... 6
The total number of accidents with hand tools.....557

Hand tools which caused accidents and the number caused by each:

Chisels 356	Hammers 14	Tin snips 2
Knives 44	Draw knives 6	Mitre saws 1
Hand saws 88	Scrapers 6	Hack saw 1
Planes 29	Cold chisels 4	Wrecking bar 1

The total number of accidents caused by power driven machinery.....156

In the first parenthesis after the name of each machine is the number of machines which the study covered and in the second is the number of accidents caused by each:

Lathes .....(827) (41)	Hand saws.....(69) (25)	Power drill.....(35) (3)
Grinders .....(115) (5)	Planers .....(40) (4)	Swing saws.....(4) (0)
Table saws ....(103) (28)	Mortisers .....(26) (0)	Sanders .....(14) (0)
Jointers .....(71) (45)	Jig saws .....(37)(4)	Shapers .....(14) (0)

[2]Max P. Henig, "Vocational School Shops," *Bulletin Number 11,* Chicago: National Safety Council Bulletin.

[3]Wayne M. Judy, "Vocational School Shops," *Bulletin No. 11,* Chicago: National Safety Council.

Causes of accidents:

Pupil carelessness	(323)	Clothing	(8)
Disobedience of rules	(101)	Improper shop arrangement	(5)
Hasty work	(67)	Metal deficiency	(5)
Improperly guarded machines	(16)	Falling objects	(4)
Crowded conditions	(14)	Jigs and fixtures	(1)
Anger	(12)	Improper lighting	(1)
Worry	(11)	Slippery floors	(1)
Working after school hours	(6)	Lack of instruction	(1)

Safety methods and the number of schools using each:

Safety talks	(185)	Merit system	(3)
Accident posters	(95)	Machine safety tests	(3)
Safety rules	(93)	Safety student councils	(3)
Safety bulletin boards	(42)	Safety awards	(3)
Safety slogans	(32)	Safety slides	(2)
Safety assignments	(22)	Safety contests	(2)

The Williamsport Safety Program

City schools within the past few years are taking a very active part in safety education.

The Williamsport Study indicates the trend in the more progressive industrial school organizations to inquire into additional elements that enter into the causes of accidents. This study represents an attempt on the part of a city school system to determine causes. Conclusions are drawn from the study made of the accidents. Improvement in safety is the goal. An article appearing in a Williamsport school pamphlet[4] contains the following account:

"One of the most important problems of the present-day in industry is Safety. Special programs are being organized and put in practice. Men are being prepared along these lines by companies in order to better carry out the safety programs for the protection of their employes. Hence, there is no further need of explanation as to why it is an essential feature in our Industrial Education Program.

"Safety education has been a part of the industrial education program in Williamsport since the department has been organized in 1920, but not until the year 1929 has the problem been carefully studied from the teaching viewpoint. Previous to last year, we had been interested chiefly in the prevention of serious accidents and failed to follow up the smaller injuries, such as scratches, small cuts, and bruises. We realize in these present-day needs that all accidents should be given immediate attention and reported to the proper authorities.

"During the past year we developed an accident report blank, which is filled out by the instructor in charge of the shop, for every accident in which the skin is broken. From the reports received from one term, sixty-two in number, we were forced to recognize two important truths—first, that we were neglecting a special educational opportunity by failing to take the minor accidents seriously, and second, that these slight accidents are more numerous early in the term and after holidays.

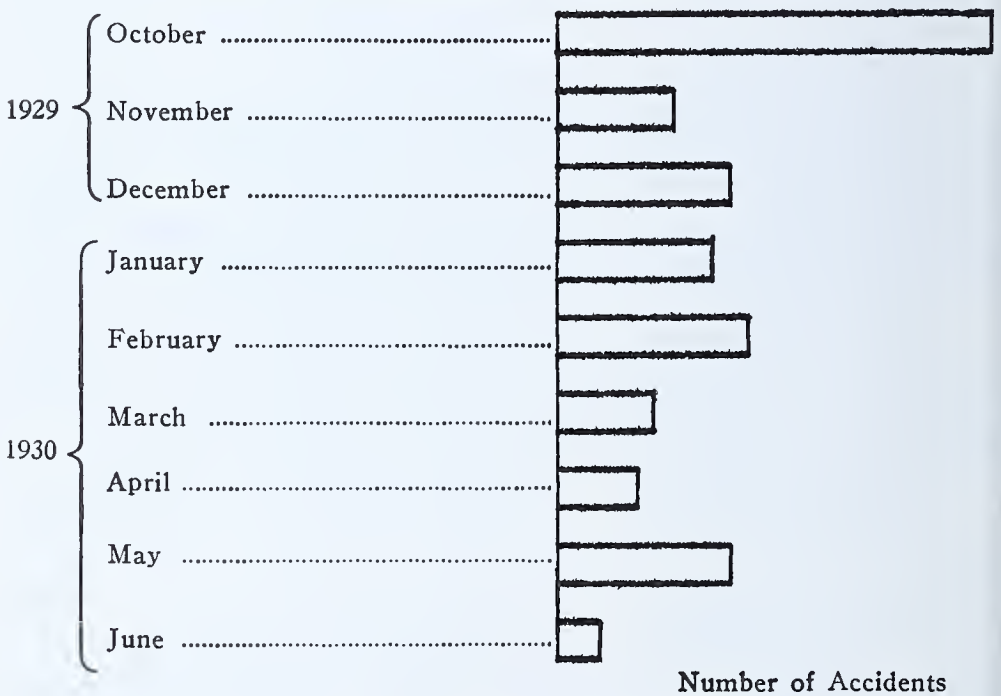
[4] A. K. Patterson, "Our Safety Program," *Training for Industry in Williamsport*, pp. 23-24. Williamsport: School District of the City of Williamsport, 1931.

Williamsport Accident Study—Time of Day

Shop	Accidents	Students	A.M.	P.M.
Cabinet	12	41	3	9
Auto	12	39	5	7
Electric	15	41	6	9
Printing	1	22	1	..
Machine	16	40	8	8
General	6	....	1	5

"The realization of this second truth immediately indicated that preparation and experience might reduce the number of these minor accidents. The following bar graph will show clearly the trend of accidents in our shops during the past year:

Williamsport Accident Study—By Months of the Year



Scale—⅛ inch per Accident

"The following conclusions have been made from a study of the reports and from other information obtained on the blank forms as they were filled out:

1. That accidents are more numerous among inexperienced boys.
2. That inattentiveness, in some form or other, is the most common cause of accidents.
3. That more accidents happen in crowded shops.
4. That almost all accidents are avoidable.
5. That mechanical safeguarding can, at best, eliminate only about twenty per cent of our accidents.
6. That the great problem is a human one.

7. That three-fifths of the accidents happen in the afternoon.
8. That lack of concentration on the job is the most frequent cause of accidents.
9. That defective judgment is an important cause.
10. That mechanical defects cause a negligible number of accidents.
11. That disobeying instructions causes some accidents.

"The program of safety education is gradually being built around our store of information. It is our intention to base the curriculum upon the known needs of our particular situation rather than to import a system developed for another situation. We do not have a set method of teaching safety. We place the burden of safety education on the shop teacher because we feel that the shop is the logical laboratory for teaching safe working practice. We are doing very little formal class-room work in safety because we hesitate to add another subject to the already crowded curriculum. Posters are being used to some extent, but we are of the opinion that too much poster work is dangerous. It is also true that too much talk about safety is a bad thing and we try to do a minimum of lecturing and a considerable amount of individual instruction. Each shop teacher has his own method of putting safety across to his boys, due to the fact that each trade has its own safety rules and regulations.

"We hold a membership in the National Safety Council, and a great deal of safety instruction is secured through this organization.

"The experiments so far conducted confirm our opinion that a safety consciousness which will be carried over into industry can be built up in our school. We think we can so safeguard our equipment and educate our boys that accidents will be of the truly avoidable type, and we hope very rare occurrences. It is our desire that our students may go into industry as safe workers, who will help to diminish the tremendous economic and social losses in industry."

Williamsport School Accident Report

Date.....

Name .....
Last Name First Name Middle Initial

School or Department in which accident occurred.....

Nature of injury.....

.....

Time of accident.....Disposal of case.....

.....

Students contributing .....

Students who saw accident.....

Instructor's opinion of cause of accident.....

.....

Accident report to be filled in for all accidents in which skin is broken or injury is otherwise apparent.

School Accident Report
School District of Williamsport

The Philadelphia Study

The Philadelphia Public Schools study[5] their accident record in comparison with the enrollment in the junior high, vocational, senior high, and evening high school. An attempt at an exposure study in comparison with the accidents in kind and severity is in harmony with the more recent trend in other organizations making safety studies.

The Philadelphia study covers an extended period. The following table covers ten years:

ACCIDENTS IN SCHOOL SHOPS REQUIRING SCHOOL DOCTOR OR HOSPITAL ATTENTION

Year	Type of School	Type of Shop	Machine, Tool, or Material	Number of cases in Year	Enrollment in Shops
1923	Junior High	Metal	Square shears	1	13,176
1924	Contin.	Wood	Sanding machine	4	15,643
	Junior	Wood	Jointer, 6"		
	Evening	Wood	Jointer		
	Senior	Wood	Jointer		
1925	Evening	Wood	Jointer	6	17,961
	Junior	Wood	Jointer		
	Junior	Wood	Jointer		
	Junior	Wood	Jointer		
	Junior	Metal	Hand file		
	Junior	Wood	Jointer		
1926	Evening	Wood	Circular saw	7	19,502
	Evening	Wood	Circular saw		
	Junior	Wood	Jointer		
	Junior	Wood	Jointer		
	Junior	Wood	Lathe		
	Junior	Elec.	Jack knife		
	Junior	Wood	Band saw		
1927	Junior	Wood	Lathe	4	19,907
	Contin.	Wood	Jointer		
	Junior	Wood	Jointer		
	Junior	Wood	Jointer		
1928	Junior	Wood	Jointer	2	23,784
	Junior	Metal	Square shears		
1929	Junior	Metal	Tinplate	1	26,055
1930	Junior	Metal	Jointer	4	
	Junior	Metal	Chisel		
	Junior	Metal	Chisel		
	Evening	Metal	Jointer		
1931	Junior	Metal	Sanding machine	4	26,789
	Junior	Metal	Band saw		
	Senior	Metal	Drill press		
	Senior	Metal	Grinder		
1932	Junior	Wood	Band saw	3	28,877
	Junior	Wood	Marking gauge		
	Senior	Wood	Circular saw		

[5]This accident information is secured from unpublished safety material in the Philadelphia City School Administration Offices, Philadelphia.

Summary 1923-1932

Shop	Number of cases	Circular saw	Jointer	Sanding machine	Band saw	Lathe	Hand Tools	Square shears	Drill press	Grinder	Materials
Wood	29	3	16	2	3	2	3	....	....	....	....
Metal	6	....	....	....	....	....	1	2	1	1	1
Elec.	1	....	....	....	....	....	1	....	....	....	....

Total: 36

The Hershey School Accident Record[6]

Hershey is representative of the smaller town. They, too, keep records of accidents. This study, like the Philadelphia Study, takes into account the number of students in comparison to the number of accidents. The following three year report indicates their accident record:

Year	Number of Students	Number of Accidents	Description and Remarks
1930-31	89	5	Four cuts about the hands; one eye scratched, slight.
1931-32	118	6	Five small cuts and one burn.
1932-33	138	12	Three dirt in eye; eight ordinary cuts about hands.
		One major accident—	One little finger amputated between first and second joint.

"The one major accident was absolutely due to carelessness and not lack of instruction or guards. While using a portable drill the operator attempted to hold job to be drilled in hand with the result the job caught in drill and wrapped about finger pinching it off at first joint.

"In 1930-31, four of the five accidents were during the last month of school.

"In 1931-32, three of the six accidents were during the first month of school.

"In 1932-33, ten of the twelve accidents took place during the month of October.

"Not one accident was due to machinery being improperly guarded.

"We feel with the amount of work carried on in these shops where there is sufficient equipment for all boys to be kept busy at all times, our accident list is low and we shall make every effort to keep it so."

Industrial Safety Program of the Pittsburgh Public Trade School

The Pittsburgh Public Trade School Safety Program was developed by a committee of men on the industrial education staff with the cooperation of a group of thirty men from industry and other associations directly concerned with safety.

In Pittsburgh an accident study is made by months and type schools.

[6]This accident information is secured from unpublished safety material in the Hershey School District Office, Hershey.

Distribution of the Number of Accidents by Months and Types of Schools

	September	October	November	Total
Secondary Schools	20	34	15	69
Trade Schools	5	9	4	18
Elementary Schools	23	34	24	81
Total	48	77	43	168

Location of Scene of Accidents

Classrooms	15
Halls	9
Lavatory	4
Shops	23
Gymnasium	14
Steps	21
Playgrounds	50
Street	5
School yard	27
Total	168

The following is a copy of the Individual Accident Report which is printed on a form 5½" x 8½".

Department of Trade Training — Pittsburgh Public Schools

ACCIDENT REPORT

Date of injury..... School.....
Time: A.M..... P.M..... Department.....
Shop .....
Name..... Grade..... Age.....
Address ..... Telephone.....
Number of semesters in this course.....In this shop.....
Describe injury .....
.....Was time lost, over ½ day?.....
How treated in school?.....
..... By whom?.....
Was student sent home or to which hospital?.....
Was home notified of the injury?.....By whom?.....
Briefly describe how accident occurred.....
.....
Check cause: faulty equipment.....carelessness.....
horse play..... inexperience.....
Was student using hand tools, machinery, material, or other equipment when he was injured? .....
Was the instructor in the room at time of the accident?.....
Was the machine safeguarded?.....Were all guards in place?.....
Injured Student's Statement: The above accident report is correct statement of my injury and of the cause of the accident.
Signature.....
Have you written any suggestions on how this accident could have been avoided, using the reverse side of this report?.....
No. of days student lost.....Date of return.....
Signed.....
Student Safety Supervisor
Approved:.....
Instructor

Report Blank

This report form is a composite blank containing many of the good features in report blanks used by city schools in securing information regarding individual accidents.

INDIVIDUAL ACCIDENT REPORT

.....School
.....Instructor
.....Shop
Name..... Grade..... Age.....
Address..... Telephone.....
Describe Injury .....
How Treated .....
By Whom .....
Date Injured..... Time..... A.M..... P.M.....
How many semesters has this student been in this shop?.....
If taken to hospital, family was notified by whom?.....
Was student using hand tools, machine, or other equipment? Explain.....
.....
Was machine equipped with safe guards?.....
Was the instructor present when accident occurred?.....
Describe briefly how accident happened?.....
.....
Did student lose any time?.....hours..... days.....
Have you written any suggestions how this accident could have been avoided on the reverse side of this report?.....
Signed.....
Shop Safety Supervisor
Approved: .....
Shop Instructor
(This report must be filled out in ink and sent to the office on Friday.)

The Lancaster City School Safety Program

The Lancaster City Schools have been studying their accident record for a period of years. They have also studied plans and programs as outlined in published material from other cities, states, and associations and prepared a safety education program for their own city school shops.

One of the interesting features of their report[7] provides for definite checks indicating whether safety instruction was given and whether the instructor cooperated. One hundred per cent effective instruction is expected.

PUPIL'S STATEMENT OF PROFICIENCY IN SAFETY INSTRUCTION —AUTOMOBILE MECHANICS SHOPS

THIS IS TO CERTIFY THAT I HAVE BEEN GIVEN INSTRUCTION IN SAFETY PRECAUTIONS IN THE AUTOMOBILE MECHANICS SHOP COMPRISING:

TESTING, DRIVING, AND ALL OTHER ADVANCED WORK, EXCEPT WELDING

My instructor has demonstrated and taught me how to **safely** test, drive, and do other advanced work, and I have demonstrated my ability to do this in a safe manner.

I promise to observe all safety precautions and not to operate any tools or machines unless I have first read and signed the pupil statement of proficiency in safety instruction for these tools or machines.

If I am ever in doubt regarding the doing of any operation in the **safest** way, I promise to first get the necessary safety instruction from the instructor.

PUPIL'S SIGNATURE.....
(Date).....

[7] "Safety Standards and Recommendations for School Shops," p. 115, *Bulletin*, Lancaster: School District of the City of Lancaster, 1934.

INSTRUCTOR'S CERTIFICATION OF THE PUPIL'S SAFETY INSTRUCTION

This is to certify that ..... the above named pupil, has been given safety first instruction and demonstration in testing, driving, and other advanced work except welding.

He has passed the safety test covering the operation of the aforementioned operations and has made a grade in that test of one hundred per cent, his original paper being attached hereto as evidence of this fact.

INSTRUCTOR'S SIGNATURE .....

(Date) .....

TO THE INSTRUCTOR: This statement must be kept filed at all times while pupil is enrolled or working in your shop, together with his original SAFETY FIRST TEST ANSWERS and PARENT'S PERMISSION CARD.

Form S-3

The following pledge of cooperation is to be signed and returned to the Director of Vocational Education at your earliest convenience, after having read through your copy of SAFETY STANDARDS AND RECOMMENDATIONS.

Your signature to this pledge will signify your willingness to cooperate and will also assure the Director that your copy of SAFETY STANDARDS AND RECOMMENDATIONS has been received.

DETACH AND PRESENT TO THE DIRECTOR OF VOCATIONAL EDUCATION

— — — — — — — — — — — — — — — — — — — —

— — — — — — — — — — — — — — — — — — — —

This is to certify that the under-signed has carefully read and fully understands the recommendations and suggestions given in "SAFETY STANDARDS AND RECOMMENDATIONS" book and will cooperate in every way to further safety in the Lancaster Public School Shops.

Date..... Signature of the Instructor.....

CONCLUSIONS

As indicated in the first part of this chapter, a review of the safety studies made indicates an increasing interest in safety as a most important part of the industrial education program.

The studies indicate a wide range of interest in subject-matter and very little uniformity at this stage.

Practically all studies are concerned with location of accident and cause of accident. A few indicate an interest in a search for additional information through a study of such factors as the health of the student and the time when the accident occurred. An attempt in some few studies tends towards a discovery of the so-called human factors. Most studies merely furnish data regarding accidents. A few studies include conclusions drawn from the studies made.

There is a growing recognition of the value of the careful studying of accident records. Few studies give any indication of carefully prepared report forms which would aid in securing more complete accounts of accidents and injuries and the tabulation of this information.

No previous state-wide study regarding school-shop accidents in Pennsylvania was revealed in a review of the studies previously made.

Briefly, the studies reveal keen interest in the subject and a concern about the solution of the safety problem in general. Many other studies have been merely fact-gathering projects; very few have drawn definite conclusions or set up positive safety programs of education. To reduce the number of accidents there must be more effective teaching of safety.

Chapter IV

The Procedure and Methods Used in This Study

In an effort to secure raw data regarding school shop accidents on a state-wide basis throughout Pennsylvania, the Superintendent of Public Instruction addressed a letter to all of the superintendents of schools and supervising principals of schools in which either industrial arts or vocational industrial education was offered. On the following page appears a copy of the letter.

This study was to cover a period of one year during which time all districts willing to cooperate were requested to send in their reports covering each school shop accident injury.

THE LIBRARY METHOD EMPLOYED IN DEVELOPING THE QUESTIONNAIRE

A form of library method was employed in reviewing other important studies made in safety education, such as the books and pamphlets available on this subject in developing a questionnaire. An attempt was made to develop a questionnaire that would simplify reporting and yet give complete and reasonably reliable information. Forms used for reporting accidents to state Departments of Labor and Industry, by safety associations, by industry, and twenty city schools, were carefully studied, particularly to note the frequency of questions asked. A large variety of safety literature was reviewed to note anticipated replies to the questions. The anticipated or possible replies were listed and incorporated in the questionnaire to aid in simplifying filling in reports of accidents.

This letter was sent to school districts inviting their cooperation in this study.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg

Dear Sir:

We are planning an intensive study of school shop accidents as a basis for developing a program to eliminate hazards which are the cause of accidents in public school shops. In this study we are enlisting the cooperation of superintendents and other school officials.

The purpose of the study will be to secure accurate and complete information concerning school shop accidents and the injuries resulting therefrom. If we can find out the conditions under which accidents occur, we shall be able to formulate safety education measures to guide shop practice. No effort will be made to compare districts. Each shop and drafting room will be the unit on which the study will be based and each accident injury will be reported separately.

We are enclosing copies of the industrial school accident injury report blank which has been devised by Mr. Cressman with the cooperation of the Bureau of Inspection of the Department of Labor and Industry. It is proposed that a report be sent to the Department of Public Instruction covering each accident injury in the school shops of the State for the school year closing June 30, 1934.

We shall appreciate your cooperation in this project.

Sincerely yours,

We should like to cooperate in the industrial school accident injury study. We will probably need.....Industrial School Accident Injury Report Blanks.

.....
(Signature)

To **illustrate**:

27 Shop
00 Art metal
01 Automotive
02 Beauty culture
03 Brick laying
04 Commercial art
05 Cooking
06 Drafting
07 Electrical
08 Forging
09 Foundry
10 General
11 Machine
12 Millinery
13 Painting
14 Pattern making
15 Plumbing
16 Printing
17 Power operating
18 Sewing
19 Sheetmetal
20 Tailoring
21 Textiles
22 Welding
23 Woodworking
24 .....

QUESTIONNAIRE CHECKED IN ADVANCE FOR TABULATION

These numbers appearing before each subject, as "27 Shop" referred to the place provided in the Hollerith tabulating card for tabulation purposes. This was also true of the numbers before the name of the shop. Thus a circle around "01 Automotive" not only provided the information as to the shop in which the accident occurred, but also furnished the code number for tabulation purposes. The distribution of subjects on the tabulation card appears on pages 22 and 23.

This point might be greatly amplified as will be readily noticed. Particularly the list of "What was responsible for the accident?" was developed from a study of the frequency of these possible replies referred to in safety literature. Where there was a possibility of an additional reply other than those listed, space was provided for such replies.

HOLLERITH TABULATING CARD

Identification Number				Description of Accident		Description of Injury		First Aid	Hospital	Treatment	Parent Notified	Shop Crowded	Sufficient Equipment	Illumination	Glare	Name of Tool or Machine	Guards Equipt	Guards in Use	Housekeeping	Instruction in Shop	Permission
0				0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
1				1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
2				2		2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
3				3		3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
4				4		4		4	4	4	4	4	4	4	4	4	4	4	4	4	4
5				5		5		5	5	5	5	5	5	5	5	5	5	5	5	5	5
6				6		6		6	6	6	6	6	6	6	6	6	6	6	6	6	6
7				7		7		7	7	7	7	7	7	7	7	7	7	7	7	7	7
8				8		8		8	8	8	8	8	8	8	8	8	8	8	8	8	8
9				9		9		9	9	9	9	9	9	9	9	9	9	9	9	9	9
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Hollerith Tabulating Card (Continued)

Pupil Instructed	School	Grade	Shop	Safety Engineer	Size Class	Age	Month	Day	Hour of Day	Hours	Days Lost	Months	Semesters	Severity	Who Responsible	What was responsible
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

THE QUESTIONNAIRE

One thousand (1000) report forms were provided on which to secure reports of accidents. This supply was quickly exhausted. Additional forms were requested until the demand required a total of ten thousand (10,000) copies.

Beyond doubt most of these forms were used as safety instructional material and also to study the style of the questionnaire.

The following questionnaire was sent out to all districts expressing willingness to cooperate.

School District.....

Name of School.....

Date .....

Commonwealth of Pennsylvania
DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg

The Education Bureau
Division of Industrial Education

INDUSTRIAL SCHOOL ACCIDENT INJURY REPORT

Name..... .... Address.....
Last First Initials

5. Description of the Accident.....

.....

7. Description of the Injury.....

.....

Place a circle around the right number opposite the word, words or figure representing the correct information as "(1) Yes". If words and figures are inadequate, supply the information on the blank line. See "Suggestions for Reporting Industrial School Accident Injuries."

9. Was first aid given? 1. YES 2. NO If so, by whom?.....

10. Was pupil taken to hospital? 1. YES 2. NO If so, by whom?.....

11. Was hospital treatment given? 1. YES 2. NO Doctor?.....

12. Was parent notified of injury? 1. YES 2. NO If so, by whom?.....

13. Was the shop crowded? 1. YES 2. NO

14. Was there sufficient equipment? 1. YES 2. NO

15. Was adequate illumination provided? 1. YES 2. NO

16. Did glare exist? 1. YES 2. NO

17. Name of tool or machine on which accident occurred.....

19. Was the machine tool equipped with approved safety guards? 1. YES 2. NO

20. Were the guards in use? 1. YES 2. NO

21. Was there good housekeeping? 1. YES 2. NO

22. Was the instructor in the shop when the accident occurred? 1. YES 2. NO

23. If accident happened on a power driven machine tool, had permission been granted by parent or guardian to operate the same? 1. YES 2. NO 3. Not required by school

24. Had this pupil been properly instructed about the hazards involved in this particular situation which caused the accident? 1. YES 2. NO

25. School
- 0—Elementary school
- 1—Junior high school
- 2—Senior high school
- 3—Trade school
- 4—Evening school
- 5—Special school
- 6—.....

26. Grade
- 0—1-6
- 1—7
- 2—8
- 3—9
- 4—10
- 5—11
- 6—12
- 7—Post graduates
- 8—Trade extension
- 9—Ungraded

27. Shop
- 00—Art metal
- 01—Automotive
- 02—Beauty culture
- 03—Brick laying
- 04—Commercial art
- 05—Cooking
- 06—Drafting
- 07—Electrical
- 08—Forging
- 09—Foundry
- 10—General
- 11—Machine
- 12—Millinery
- 13—Painting
- 14—Pattern making
- 15—Plumbing
- 16—Printing
- 17—Power operating
- 18—Sewing
- 19—Sheetmetal
- 20—Tailoring
- 21—Textiles
- 22—Welding
- 23—Woodworking
- 24—.....

30. Size class
.....

32. Age
.....

34. Month
- 0—September
- 1—October
- 2—November
- 3—December
- 4—January
- 5—February
- 6—March
- 7—April
- 8—May
- 9—June

35. Day
- 0—Monday
- 1—Tuesday

2—Wednesday
3—Thursday
4—Friday
5—Saturday

36. Hour
00—8 A.M.
01—9 A.M.
02—10 A.M.
03—11 A.M.
04—12 M.
05—1 P.M.
06—2 P.M.
07—3 P.M.
08—4 P.M.
09—5 P.M.
10—6 P.M.
11—7 P.M.
12—8 P.M.
13—9 P.M.

Time lost

38. .....hours

39. .....days

40. .....month

41. Number of semesters in this shop
.....

42. Severity of accident injury
0—Common—did not require first aid
1—Minor—required first aid treatment only
2—Severe—medical aid—stitches or setting bones, etc.
3—Serious—lost use of member of the body
4—Critical—may cause death
5—Death—occurred as result of accident

43. Who was responsible for the accident?
0—Student injured
1—Other students
2—Teachers
3—Director of Indus. Ed.
4—Supt. of schools
5—School board
6—Visitors
7—.....

44. What was responsible for the accident?
00—Lack of instruction
01—Lack of supervision
02—Failure to carry out instruction
03—Improper position of body, hands, etc.
04—Hasty work
05—Inattentiveness
06—Poor health
07—Worry
08—Anger
09—Horse play
10—Inadequate light
11—Glaring light
12—Falls
13—Slippery floors
14—Poor housekeeping
15—Struck by objects
16—Loose clothing
17—Handling materials
18—Dull tools
19—Defective tools or equipment
20—Misuse of tools or equipment
21—Stock held insecurely
22—Stock too short
23—Feeding stock too fast

24—Adjusting guards while machine was running
25—Reaching in rear of saw to guide stock
26—Improper speed of machine
27—Guards not used
28—Lack of proper guards
29—Obsolete equipment
30—Failure to wear goggles
31—Not enough equipment to give each student a working location
32—.....
33—.....

.....
Student Safety Engineer

.....
Instructor

.....
Supervisor, Director or Principal

The Instruction Sheet

An instruction sheet, a copy of which appears on pages 26 and 27 was sent to each school shop instructor cooperating in this study. These instruction sheets were planned to explain in detail the proper use of the accident report forms.

SUGGESTIONS FOR REPORTING INDUSTRIAL SCHOOL ACCIDENT INJURIES

1. School districts having trade and industrial arts work are invited to cooperate in this study for the purpose of discovering the nature and causes of school shop accident injuries.
2. The study should be as extensive as possible so that a true picture of the situation in Pennsylvania may be secured.
3. Districts willing to cooperate in this study should notify the Department of Public Instruction so that mailing lists can be compiled.
4. The study is to cover this entire school year from September to the closing of school in May or June.
5. Reports of accident injuries should be sent in during the year—preferably January 1, April 1 and end of school year.
6. Additional industrial school accident injury report blanks will be sent upon application.
7. The report blank is set up in such form as to reduce the work of "filling in" a report, to the minimum, and also to be tabulated on Hollerith Tabulation Cards.
8. Districts are invited to send in successful safety prevention suggestions. Photographs of safety devices will be useful.
9. Figure the total number of hours all the students spent in the shops during the year in order that we can calculate the exposures per injury. This will give more nearly a true index figure of the hazard. This should be tabulated at the end of the school year by

Elementary school .....Student shop hours exposure
Junior high school.....Student shop hours exposure
Senior high school.....Student shop hours exposure
Trade school .....Student shop hours exposure
Evening school .....Student shop hours exposure
Special school .....Student shop hours exposure

10. In the industrial school accident report blank the numbers used beginning with 5 refer to a certain item of information and also a certain space on the Hollerith Tabulation Card. Further explanation is offered here to clarify the information desired for several of these items.

    Leave items blank if they do not apply.

    9 to **24.** Answers to most of these questions should be Yes or No.

    13. Answer Yes or No. A minimum of at least 40 square feet per student is usually needed in an average shop. There are other factors in "crowded" conditions beside floor space which may be considered.

    14. Equipment adequate to provide each student in the class with a working location.

    15. Conforms to "American Standard Codes of Lighting School Buildings," United States Department of Labor, #382 from Superintendent of Documents, 10c a copy. "Regulations for Industrial Lighting," Department of Labor and Industry, Harrisburg, Pa.

    19. The machine where the injury occurred was guarded with approved guards in accordance with regulations in the State Department of Labor and Industry.

    20. The guards were or were not used when the accident injury occurred.

    21. Clean, orderly, in place, system.

    25 to **44.** Place a circle around the right number opposite the proper answer as, ①—Junior high school. If the name of the type school does not appear, place it in—⑥—with name written in, etc.

    30. Size of the class present in the room where the accident occurred.

    32. Give age by year only as 14, etc.

    36. The time between 7:30 A.M. and 8:30 A.M. should be reported as 8:00 A.M., etc.

    41. How many semesters was the boy in this shop or type of work as electricity, printing, etc. when the accident occurred?

    42. Every accident injury is reportable under these six degrees of severity.

    43. Be as fair as possible in your judgment and conclusion as to who was responsible. Let the final decision rest with the supervisor, director or principal.

    44. Place circles around several of these or other causes if more than one cause contributed to the accident.

    Additional causes may be written in lines 32 and 33 if desired.

Let each class have some one who is assigned as student safety engineer who will check up to see that students work safely, and assist in all safety measures.

This letter was sent to school districts as a last request for unreported school-shop accident injury reports.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg

In bringing to a close the School-Shop Accident Injury Study, we should like to have you check the statement below which is appropriate to your situation and return this letter to us.

The response of the schools cooperating in this study has been most gratifying. From these reports, we believe that it will be possible to formulate suggestions for state-wide use in reducing accident injuries in Pennsylvania's school shops. At this time, we shall appreciate it if all additional reports may be filed as soon as possible. Any suggestions which you or members of your staff care to make concerning shop safety will be greatly appreciated.

Will you express my personal appreciation to members of your staff who have participated in the study. A summary report will be sent to you just as soon as the results can be tabulated and evaluated.

Sincerely yours,

☐ 1. We did not have any accident injuries in our school shop this year.
☐ 2. We had accident injuries in our school shop this year and have sent you the reports.
☐ 3. We had accident injuries, but did not send the reports for the following reasons:

THE LIBRARY METHOD USED TO STUDY DEFINITIONS

Accident Injury. The library method was further employed in a study of definitions of accidents. Here as examples are six of the better definitions that were taken into account in formulating a definition of "accident" as used in this study:

1. When a person is injured to the extent that he loses two or more days' time. — Department of Labor and Industry, Commonwealth of Pennsylvania.
2. A lost time injury is one causing loss of time beyond the remainder of the day or shift. — C. W. A.
3. Every mishap that results in an injury that requires treatment is a reportable accident. — Henig — Essex County Vocational School, New Jersey.
4. Any occurrence which causes injury to the body should be regarded as an accident and treated as such. — Detroit Public Schools, Detroit, Michigan.
5. When the skin is punctured so that a drop of blood appears, it is listed as an accident. Bad bruises and broken bones or injury of any kind are considered accidents even though no blood appears. — Junior Mechanics Clubs, Lansing, Michigan.
6. An accident is defined by Webster as "an event that takes place without one's foresight or expectation; sudden or unexpected event; undesigned and unforeseen occurrence of an unfortunate and usually afflictive character."— Lancaster Public Schools, Lancaster, Pennsylvania.

For purposes of this study the following definition was proposed. **Every mishap that causes injury to the body or member of the body should be considered as an accident injury.**

Severity Defined. A more accurate and complete report was possible if the severity of the injury would be recorded in a uniform manner. For this reason the severity of injury was further defined as follows:

0—**Common**—did not require first aid.
1—**Minor**—required first aid treatment only.
2—**Severe**—medical aid—stitches or setting bones, etc.
3—**Serious**—lost use of member of the body.
4—**Critical**—may cause death.
5—**Death**—occurred as result of accident.

THE INTERVIEW METHOD

The interview method was used with two groups: (1) Safety men, and (2) Shop teachers. In making these interviews the following items were noted:

1. The nature of the safety organization.
2. Review of the safety organization.
3. Note successful methods of teaching safety.
4. Note ways and means of developing safety-conscious workers.
5. Note method of reporting accidents.
6. Note degree of completeness of records.
7. Note new mechanical safety devices.
8. Secure safety literature developed locally.

CONCLUSIONS

The procedure and methods used in this study produced the information desired; viz., a thousand and forty-one accident injury reports from school districts well distributed throughout Pennsylvania. The information contained in these reports was in usable form and could readily be tabulated.

The extent of the response from the school districts was all that could be expected considering the fact that this study was projected with no previous announcement and no attempt to prepare teachers to assist in making such a study.

The materials and suggestions secured from industry, associations, and school officials revealed an exceptionally liberal, cooperative, and splendid attitude of helpfulness.

If it be true that the end justifies the means, then the procedure and methods employed met the needs of this problem, and the results desired were attained.

Chapter V

The Findings of This Study

SCHOOL DISTRICTS COOPERATING

A letter sent by the Superintendent of Public Instruction, appear on page 21. This letter was sent to all the school districts in th Commonwealth where industrial arts or vocational industrial educa tion was offered.

It should be noted that these 153 school districts are scattere throughout every section of the State, and that they represent school varying in size from the one-teacher shop to the largest contributo to this study, Pittsburgh.

Abington
Aliquippa
Altoona
Allentown
Ambridge
Ardmore
Arnold
Avalon
Bangor
Beaver
Bellevue
Belle Vernon
Bethel Twp.
Bethlehem
Berwyn
Blairsville
Bloomsburg
Bradford
Brookville
California
Canton
Carlisle
Cass Township
Chester
Clairton
Clarks Summit
Clifton Heights
Clearfield
Coatesville
Conemaugh
Connellsville
Conshohocken
Coopersburg
Corry
Crafton
Darby
Derry
Donora
Doylestown
East Deer Township
East Greenville
East Huntingdon Township
East Mauch Chunk
East Stroudsburg
East Washington
Easton
Ellwood City
Emlenton
Emporium
Erie
Falls Township
Fleetwood
Franklin
Franklin Boro
Glen Lyon
Glen-Nor
Green Dreher
Hamburg
Hatboro
Heckville
Hershey
Homestead
Indiana
Ingram
Jeannette
Johnstown
Kane
Kutztown
Lancaster City
Lancaster—
Thaddeus Stevens
Lansdale
Lansdowne
Lansford
Latrobe
Lebanon
Leechburg
Lehighton
Lemoyne
Lewistown
Lititz
Lock Haven
Lower Merion Township
Lower Moreland
Mahanoy City
Mahanoy Township
Malvern
Manheim Township
Midland
Milford
Mill Creek Township
Millersville
Monessen
Morrisville
Mt. Carmel Township
Mt. Lebanon Township
Muncy
Nanticoke
Nazareth
New Castle Township
New Holland
New Kensington
Newport Township
Norristown
Northampton
Oil City
Oxford
Pennsburg
Philipsburg
Pittsburgh
Porter Township
Pottstown
Pottsville
Prospect Park
Punxsutawney
Reading
Redstone
Rochester
Rockledge
Scotland—
Soldiers-Sailors School
Scranton
Sellersville—
Perkasie
Sewickley
Shickshinny
Slatington
Southmont
Springdale
Springfield Township
Spring Township
State College
Steelton
Summit Hill
Sunbury
Swarthmore
Tamaqua
Tidioute
Topton
Tredyffrin
Tunkhannock
Turtle Creek Union
Tyrone
Uniontown
Unionville
Upper Moreland Township
Washington
Weatherly
West Chester
West Lawn
West Reading
West York
Wilkes-Barre
Williamsport
York
Youngville

Table I
NATURE OF THE ACCIDENT

5, 6. Description of the accident

Tools slipped (and hits from hammers)	408
Hand slipped (usually got in path of tool)	125
Handling stock (splinter, pinches, cuts)	103
Stock slipped (usually in feeding)	75
Cut with metal (trying to hold it)	43
Bumped into objects	27
Cut cleaning insulation off wire	22
Burns from soldering irons	22
Grasping hot objects	20
Falling tools	19
Objects thrown from machines	17
Burns from welding torch	14
Caught in revolving stock	14
Chips thrown from machines	14
Tripped	14
Sewing machine needle through finger	12
Removing steel chips by hand	11
Slipped	11
Auto-removing pistons	11
Caught in belt	8
Glass cuts	7
Tool broke	6

Discussion. Significant words or phrases were taken from the written statements on the description of the accidents. This is a partial list of the more frequent descriptive words or phrases used in describing what happened.

The points are covered in greater detail elsewhere under: Causes of the Accident; Nature of the Injury; the Severity of the Injury; and the tool or the machine on which accident occurred, etc.

Conclusion. The difficulty of description could be relieved to a degree if a list of the descriptions of the more frequent accidents could be prepared. With the aid of a key associated with this list, reporting could be facilitated in a high percentage of the cases. This list could be used in the preparation of such list.

There needs to be a differentiation between the description and the cause of the accident. An illustration of an accident report on this point might be:

Chisel slipped—the description of what happened.

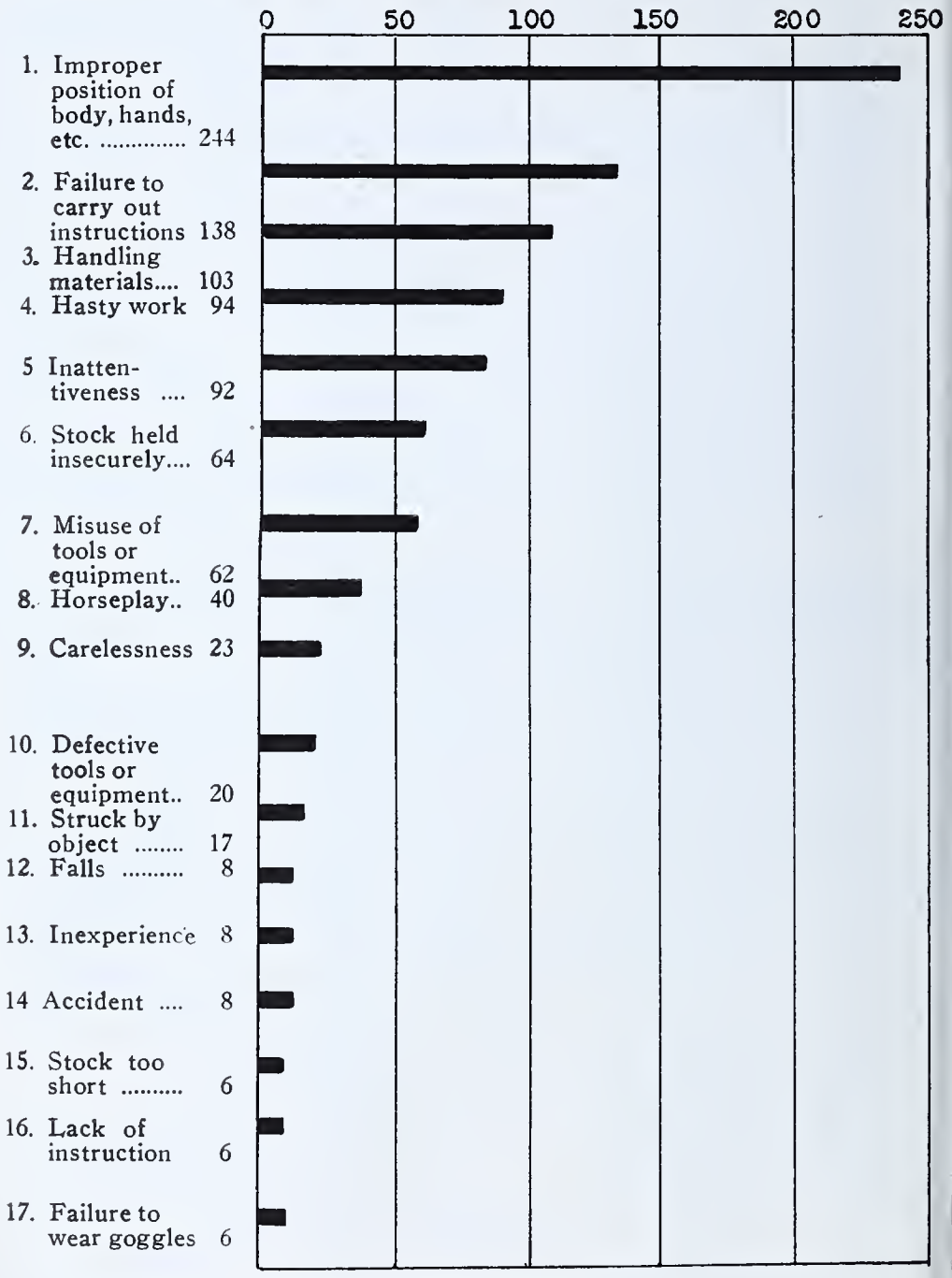
Dull tool—the cause.

*The numbers 5 and 6 in line one are index numbers referring to code numbers on the questionnaire.

Table II

CAUSES OF THE ACCIDENTS

44, 45. What was responsible for the accident?


0
50
100
150
200
250
1. Improper position of body, hands, etc. 244
2. Failure to carry out instructions 138
3. Handling materials.... 103
4. Hasty work 94
5 Inattentiveness 92
6. Stock held insecurely.... 64
7. Misuse of tools or equipment.. 62
8. Horseplay.. 40
9. Carelessness 23
10. Defective tools or equipment.. 20
11. Struck by object 17
12. Falls 8
13. Inexperience 8
14 Accident 8
15. Stock too short 6
16. Lack of instruction 6
17. Failure to wear goggles 6

Other causes of accidents assigned were:

1. Adjusting guards while machine was in motion.

*The numbers 44 and 45 in line one are index numbers referring to code numbers on the questionnaire.

The table and the chart reads as follows: Two hundred forty-four accidents were caused by an improper position of the body, hands, etc.

2. Dull tools.
3. Feeding stock too fast.
4. Guards not used.
5. Handling metal chips.
6. Inadequate light.
7. Improper speed of machine.
8. Insufficient equipment.
9. Lack of supervision.
10. Loose clothing.
11. Obsolete equipment.
12. Poor health.
13. Poor housekeeping.
14. Reaching in rear of saw to guide stock.
15. Slippery floors.
16. Worry.

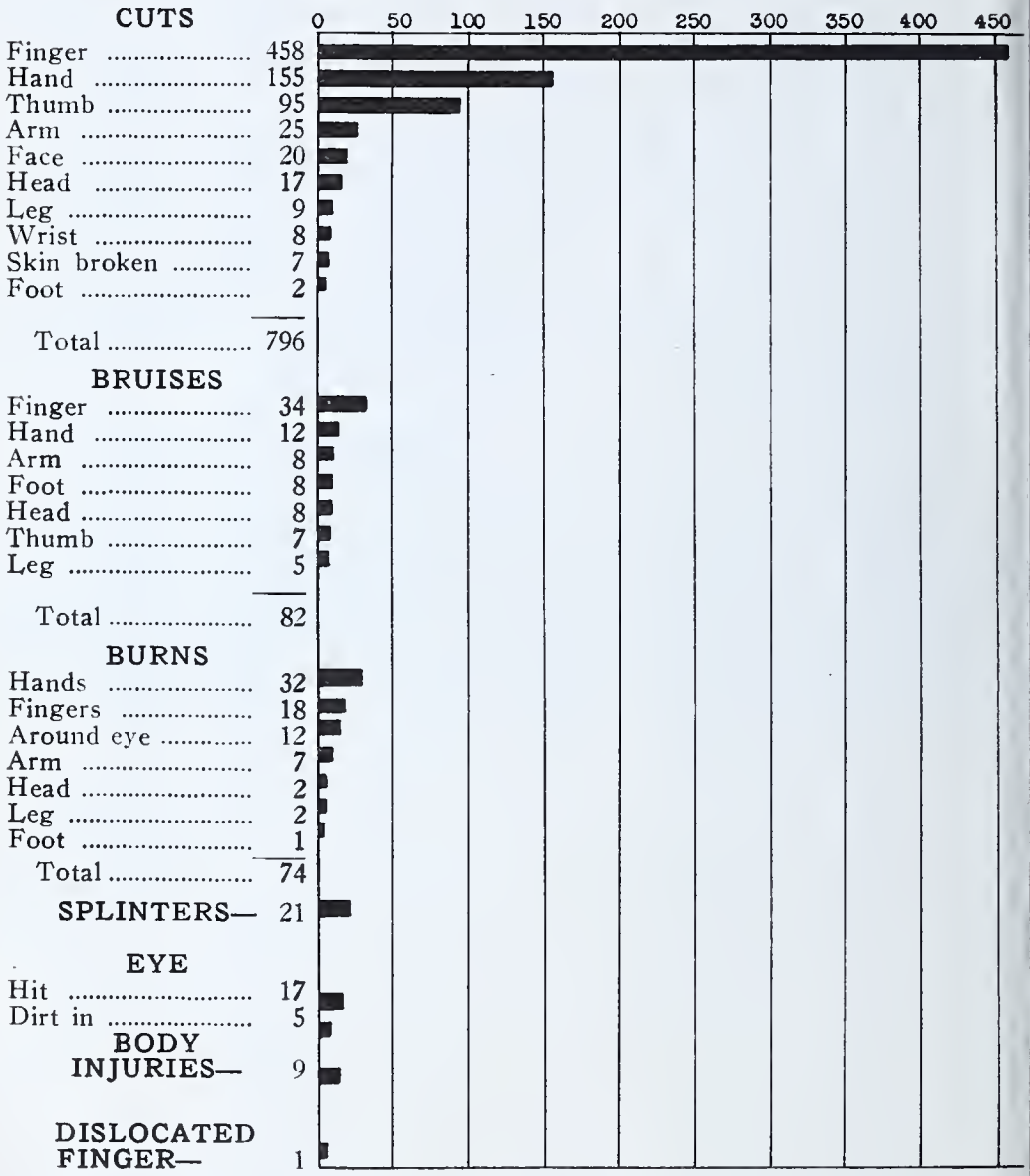
These were the causes given and are recorded as such.

Conclusion. Not all of the recorded causes of the accidents are actual causes. There are frequently close relationships between the descriptions of the accidents and the causes. The causes assigned are, no doubt, the best judgment of those reporting. There is real difficulty in analyzing a situation and determining the real cause from it. The findings of the more frequent causes, however, are significant and need further study. Recommendations are made in Chapter VII.

Table III

NATURE OF THE INJURIES

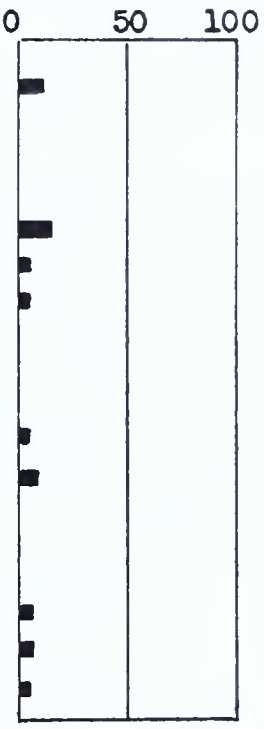
7, 8. Description of the injury



CUTS	
Finger	458
Hand	155
Thumb	95
Arm	25
Face	20
Head	17
Leg	9
Wrist	8
Skin broken	7
Foot	2
Total	796
BRUISES	
Finger	34
Hand	12
Arm	8
Foot	8
Head	8
Thumb	7
Leg	5
Total	82
BURNS	
Hands	32
Fingers	18
Around eye	12
Arm	7
Head	2
Leg	2
Foot	1
Total	74
SPLINTERS—	21
EYE	
Hit	17
Dirt in	5
BODY INJURIES—	9
DISLOCATED FINGER—	1

*The numbers 7 and 8 in line one are index numbers referring to code numbers on the questionnaire. The table and the chart read as follows:

Of the description of the injuries listed 458 resulted in "cut finger," 155 in "cut hand," etc.



CRUSHED THUMB AND FINGER	3
BROKEN	
Teeth	5
Finger	1
Toe	1
AMPUTATION	
Finger	1
End of finger	3
SPRAINS	
Ankle	2
Back	1
Wrist	1
INJURY NOT REPORTED	17
TOTAL INJURIES	1041

Discussion. There was a marked tendency on the part of those filling out reports of accident injuries to report the "Decription of the Injury" on the line asking for "Description of the Accident." This was true of at least three-fourths of the reports.

More than seventy-six per cent of the injuries are cuts, and the cut fingers account for a little less than half of all the injuries. The chisel in the wood shop is the largest single offender in accidents of all the tools, machines, etc. This subject is discussed in greater detail under "Causes of the Accident."

Practically ninety per cent of these cases were considered minor, as will be noted in Table VI. The most serious of these accidents was an amputation of a finger in one case, and the loss of three teeth from a "throw-back" from the circular saw.

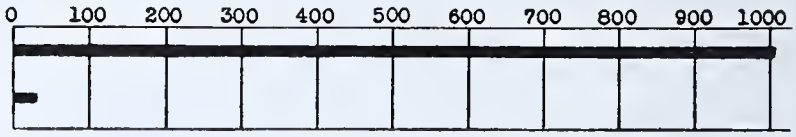
Conclusion. The two questions listed in the first part of this report form had better be transposed, asking for the "Description of the Injury" first and then the "Description of the Accident."

If stock will be fastened more securely in the vice and there is less "haste," many of these injuries can be avoided. If the recommendations outlined in the last chapter are followed, almost all of the accident injuries can be eliminated.

Table IV

TREATMENT OF THE INJURED

9. Was first aid given?



Yes	1001
No	28
No reply	12
Total	1041

10. Was pupil taken to hospital?

Yes	62
No	957
No reply	22
Total	1041

11. Was hospital treatment given?

Yes	73
No	933
No reply	35
Total	1041

12. Was parent notified of injury?

Yes	112
No	890
No reply	39
Total	1041

Discussion. In ninety-six per cent of the cases first aid was administered. It appears as though more cases were given hospital treatment than there were cases taken to the hospital. This is explained by the fact that hospital treatment was interpreted as medical treatment in a doctor's office.

School accident report forms generally call for the information listed under these four headings. In addition, information as to the name of doctor and the name of the person giving first aid, notifying parent, etc., is usually given. A complete record is generally regarded as being highly important in all school-accident records.

Conclusion. Since in 1,001 cases out of 1,041 cases first aid was given in the shop, every shop should be adequately equipped with a clean, dust-proof, well-supplied first aid cabinet or kit. Every shop should have someone prepared to administer first aid in an approved manner. Every school organization should have set up in advance of accidents a definite policy and procedure to be followed in case injuries require hospital treatment. Everyone in the school organiza-

*The numbers 9, 10, 11, and 12 appearing before each of the four questions considered in this table are index numbers referring to code numbers on the questionnaire.

The table and the chart reads as follows: To the question, "Was first aid given?" the replies indicate 1001 yes, 28, no, etc.

tion should be thoroughly familiar with these policies and procedures in order that when emergency situations arise there be no delay in securing the necessary medical attention. Only in cases where the injuries are severe or serious need the parents be notified. This should be done in all cases requiring hospital treatment.

Table V

ACCIDENT INJURIES IN RELATION TO TYPE OF SCHOOL, GRADE, SEVERITY, AND EXPOSURE

25. School
26. Grade
42. Severity of accident

Severity of Injury	Ungraded	Junior High School			Senior High School			Trade School						Post-graduate	Trade extension	Total
		7	8	9	10	11	12	7	8	9	10	11	12			
0. Common	10	5	4	1	3	4	3	2	3	8	6	10	1	2	6	68
1. Minor	7	32	75	42	34	31	23	40	86	168	138	95	54	15	10	850
2. Severe		1	7	9	7	5	6		1	7	6	3	4			56
3. Serious										1						1
4. Critical																0
5. Death																0
Total	17	38	86	52	44	40	32	42	90	184	150	108	59	17	16	975
Total by Schools	17	176			116					633				17	16	975
Total number of students		?			?					?				?	?	?
Hours exposed		?			?					?				?	?	?
Frequency rate		?			?					?				?	?	?
Severity rate		?			?					?				?	?	?

Discussion. An accident injury definition for this study was: **Every mishap that causes injury to the body or member of the body should be considered as an accident injury.** The "Severity of injury" is defined on the questionnaire as follows:

Common—did not require first aid.
Minor—required first aid treatment only.
Severe—medical aid—stitches or setting bones, etc.
Serious—lost use of member of the body.
Critical—may cause death.
Death—occurred as a result of the accident.

In sixty-six cases those reporting failed to indicate the severity of the accident injury. From a review of the descriptions of these accidents it would be reasonably safe to assume that they should have been reported as either **common** or **minor.**

The one **serious** case was an amputation of a finger. The loss of tips of fingers and teeth knocked out were reported as **severe** injuries.

*The numbers 25, 26, and 42 appearing at the top of the table are index numbers referring to code numbers on the questionnaire. The column of figures to the left of the table are code numbers used in tabulating.

There were no cases of accidents reported as **critical** or that caused **death.** Nor has any information reached the Department of Public Instruction of any accidents that severe in school shops throughout the State during the school year 1933-1934.

It will be noted that this table is incomplete. It is set up in this form to call attention to the problem. When the forms were sent out on which accidents were to be reported, an instruction sheet accompanied it. On this sheet school districts were asked to furnish the total number of hours all the students spent in the shops during the year so as to make it possible to calculate the exposure per injury, the **frequency rate,** and the **severity rate.**

It was too much to expect to have all the districts attempt to furnish this information on such short notice and limited instruction. A number of districts, however, did report this information. The following was reported from Hamburg, Pa.

Junior high school—9,970 student shop hours exposed.

Senior high school—2,700 student shop hours exposed.

Conclusion. If valid comparisons are to be made, it will be necessary to set up a method by which this can be done. The State Department of Labor and Industry in Pennsylvania uses these terms and defines them as follows:

Frequency rate = Lost time accidents per million man-hours worked.

Severity rate = Number of days lost per thousand man-hours worked.

Table VI

SIZE OF CLASS IN RELATION TO TOTAL INJURED, THE ROOM, THE EQUIPMENT, AND THE LIGHTING

30, 31. Size class?
13. Was the shop crowded?
14. Was there sufficient equipment?
15. Was adequate illumination provided?
16. Did glare exist?*

Size Class	Total Injured	Crowded			Equipment adequate			Good Housekeeping			Adequate light			Glare
		Yes	No	No Ans.	Yes	No	No Ans.	Yes	No	No Ans.	Yes	No	No Ans.	
1- 5	1		1		1			1			1			
6-10	15		15		15			15			15			
11-15	55		55		52	2	1	54		1	52	2	1	
16-20	152	8	144		144	6	2	143	6	3	144	6	2	
21-25	638	15	620	3	613	20	5	623	8	7	613	20	5	
26-30	87	32	52	3	80	5	2	72	14	1	80	5	2	
31-35	26	10	13	3	20	3	3	20	3	3	20	3	3	
36-40	11	4	6	1	10		1	10		1	10		1	
41-45	2		2		2			2			2			
46-50	1	1			1			1			1			
50-60	2	2			2			2			2			
Not indicated	51	1	40	10	41		10	39	2	10	41		10	
Total	1041	73	948	20	981	36	24	982	33	26	981	36	24	0

*The numbers 30, 31, 13, 14, 15, 16 at the top of this table refer to code numbers on the questionnaire.

It is proposed that the schools consider terms with definitions as follows:

Frequency rate = Number of accidents per million student-hours exposed.

Severity rate = Number hours lost per thousand student hours exposed.

Not until we know the student hours exposed can we make a reliable comparison in determining which age grade or shop, etc., has really greater accident risk.

Discussion. During the past year or two there has been a tendency to increase the size of classes. The frequency and distribution of accident injuries are probably in proportion to the frequency and distribution of size classes conducted in shop work throughout the State. This can not be positivitly determined from these data.

According to these reports unsatisfactory conditions exist as follows:

Seventy-three accidents occurred in **crowded** shops.

Thirty-six accidents occurred in **inadequately equipped** shops.

Thirty-six accidents occurred in **inadequately lighted shops.**

Thirty-three accidents occurred in shops **not well kept.**

Conclusion. These unsatisfactory conditions listed in the foregoing paragraph need to be corrected. It is safe to assume that in many cases they were contributing factors which caused the accidents.

No **glare** conditions prevailed where accidents occurred. Modern, well-planned lighting systems may safely be credited with having made a contribution to this situation.

Further study should be made to determine the true effect of crowding and large-sized classes on the frequency and severity of accidents.

Discussion. A study of Table VII will reveal a number of interesting facts. There were 750 accident injury cases recorded under hand tools, machines, or miscellaneous equipment. Of this number

Two hundred and ten were in woodworking shops.

One hundred and twenty-six were in machine shops.

One hundred and three were in automotive shops.

One hundred and three were in electrical shops.

Eighty-three were in general shops.

In analyzing the hand tools involved in the accidents it may be noted that there were,

Seventy chisel accidents, of which fifty-four were in the woodshop.

Forty-nine knife accidents, of which twenty-two were in the electrical shop and sixteen were in the woodshop.

Thirty-eight accidents, of which eleven were in the machine shops and nine in the automotive shops.

Thirty-four screwdriver accidents, of which twenty-eight were in in the electrical shops.

Twenty-five shovel accidents, of which twenty-four were in the general shops.

Twenty-three plane accidents, of which nineteen were in the wood shops.

Twenty-three hack saw accidents, of which nine were in the electrical shops and eight in machine shops.

Twenty-two soldering iron accidents of which twelve were in the electrical shops.

Twenty-one hand saw accidents, of which fourteen were in the wood shops.

Nineteen wrench accidents, of which thirteen were in the automotive shops.

Thirteen file accidents.

Twelve drill accidents.

In reviewing the machines involved in accidents it will be noted that there were:

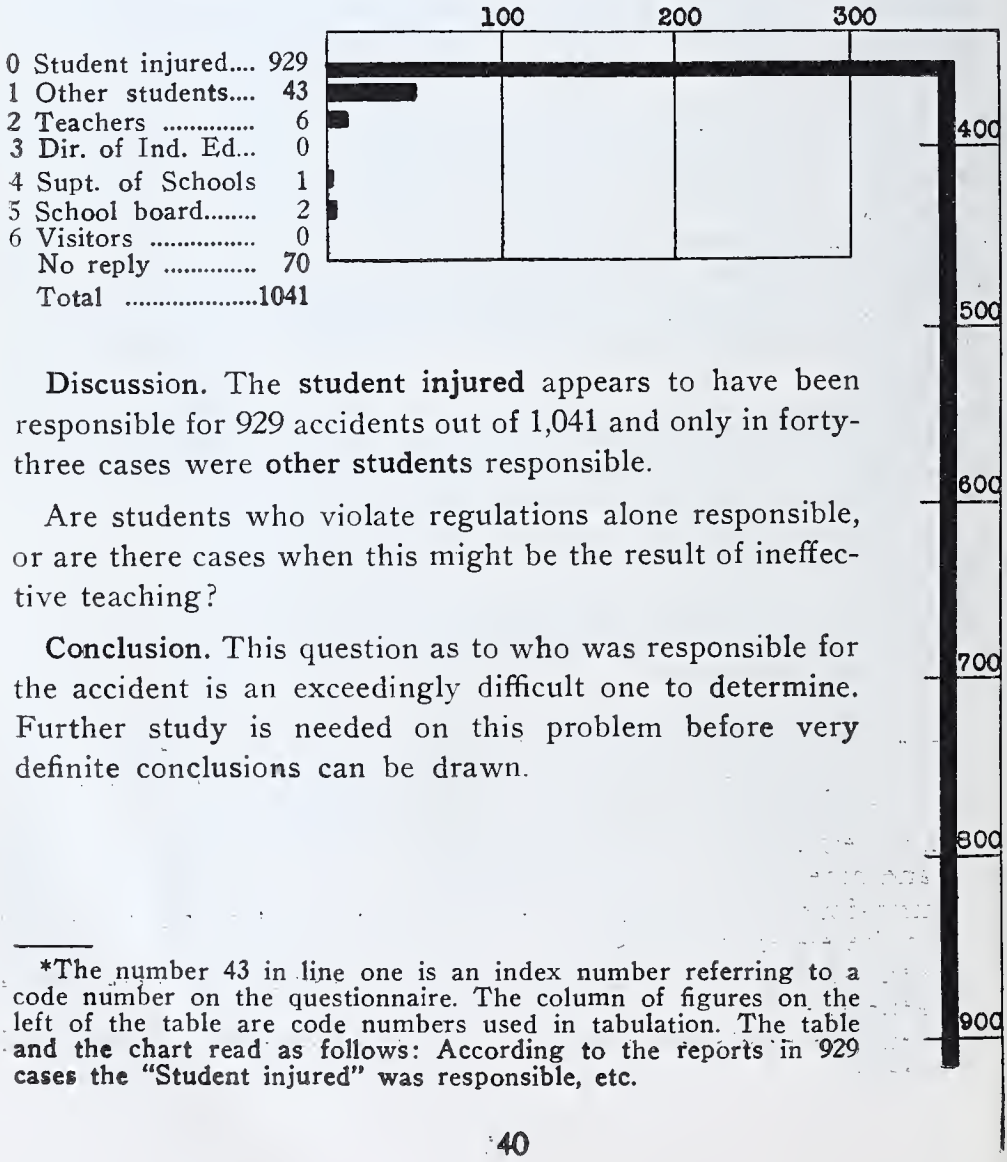
Sixty-five accidents on lathes as follows:

Lathe .....42 Engine lathe .....13 Speed lathe 10

Table VIII

PERSONS RESPONSIBLE FOR ACCIDENT

43. Who is responsible for the accident?



Discussion. The **student injured** appears to have been responsible for 929 accidents out of 1,041 and only in forty-three cases were **other students** responsible.

Are students who violate regulations alone responsible, or are there cases when this might be the result of ineffective teaching?

Conclusion. This question as to who was responsible for the accident is an exceedingly difficult one to determine. Further study is needed on this problem before very definite conclusions can be drawn.

*The number 43 in line one is an index number referring to a code number on the questionnaire. The column of figures on the left of the table are code numbers used in tabulation. The table and the chart read as follows: According to the reports in 929 cases the "Student injured" was responsible, etc.

Table VII

LOCATION OF ACCIDENTS

S.S. Shop

M.M. Man of tool or machine on which accident occurred.

| Shop | Hand Tools | | | | | | | | | | | Machine Tools | | | | | | | | | | |

Twenty-
trical s
Twenty-
electri
Twenty-
wood s
Nineteen
tive sh
Thirteen
Twelve
In revie
that there
Sixty-fiv
Lathe .....

43. Who is

0 Student in
1 Other stu
2 Teachers .
3 Dir. of In
4 Supt. of S
5 School boa
6 Visitors ....
No reply ..
Total .....

Discussic
responsible
three cases

Are stud
or are there
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*The numb
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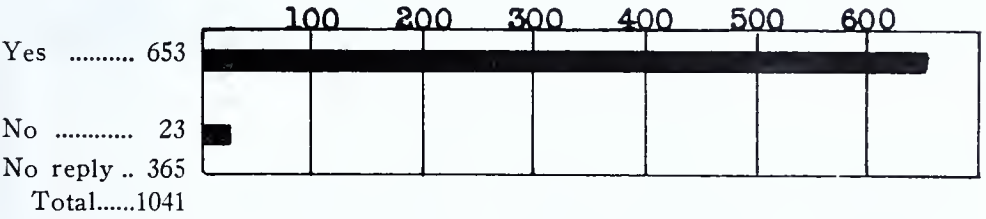
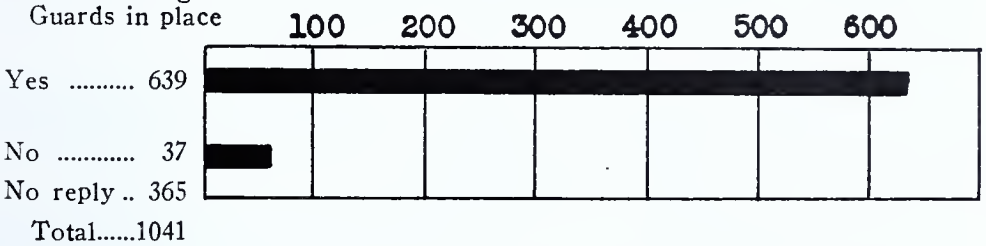
TABLE IX

GUARDED AND UNGUARDED MACHINES

19. Was the machine tool equipped with approved safety guards?
Equipped machines



20. Were the guards in use?
Guards in place



Discussion. It should be noted that more than half of the accident injuries occurred on machines. These machine accidents are analyzed in Table VIII. It was entirely proper for 365 reports to indicate no reply since the question did not apply.

Of the 653 accident cases involving machines, twenty-three machines were not equipped with safety guards. It would appear that those who reported these accidents believed the machines in the twenty-three accident cases were not equipped according to safety guard standards. Even though guards were furnished, they were not used in every case. The thirty-seven cases where the guards were not used also probably include the twenty-three cases where no guard was furnished. Thus it appears that at least in fourteen cases guards were furnished but were not used at the time the accident occurred.

Conclusion. All safety appliances as guards, etc., should be furnished on school shop machines until they measure up at least to the same standards required of machines in industry. School districts should see to it that all their school-shop machines are properly guarded. Guards should always be kept in place. Teachers should be most insistent upon this point.

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*The numbers 19 and 20 appearing before each of the questions considered in Table IX are index numbers referring to code numbers on the questionnaire. The table and the chart reads as follows: In 653 accident cases the machines were equipped with guards, etc.

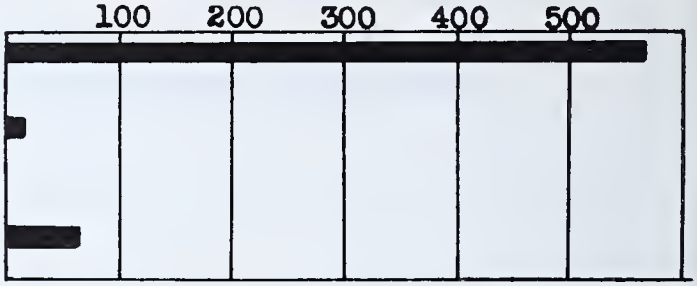
Table X

PERMISSION GRANTED TO OPERATE MACHINES

23. If accident happened on a power driven machine tool, had permission been granted by parent or guardian to operate the same?

Permission granted to operate machine

Yes	569
No	12
Not required by school	66
No reply	394
Total	1041



Discussion. The parents or guardians had granted permission to have their children operate machines in practically all of the cases where the accidents occurred on machines. More than half the accidents reported occurred on machines.

The "No" reply should not be interpreted as meaning that students were permitted to operate machines contrary to their parents' wishes. A checking back in three out of the twelve "no" cases showed that they should have been reported under "Not required by school."

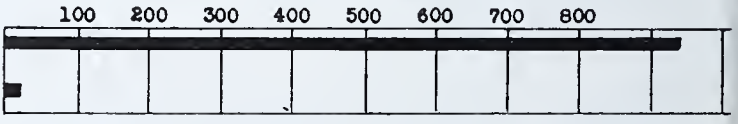
Conclusion. Securing the parents' permission to have their children operate machines in school shops appears to be a widely accepted practice. This affords also another opportunity to call the parents' and students' attention to the element of risk and to the need for working safely.

Table XI

STUDENTS INSTRUCTED REGARDING HAZARDS

24. Had this pupil been properly instructed about the hazards involved in this particular situation which caused the accident?†

Yes	924
No	22
No reply	95
Total	1041



Discussion. In 924 out of 1,041 cases those reporting accident injuries claim that students had been instructed in the hazards involved in the situation which caused the accident. This phase of the study may well be considered under "Causes of the accidents" in this chapter. The question raised by some leaders in safety might be, "How well were they taught?" or "How effective was the safety instruction?"

*The number 23 on line one of Table X is an index number referring to a code number on the questionnaire. The table and the chart reads as follows: In 569 cases reported the parent or guardian granted permission to operate the machine in question, etc.

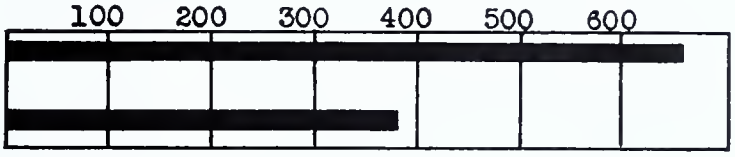
†The number 24 in line one of Table XI is an index number referring to a code number on the questionnaire. The table and the chart reads as follows: According to the reports in 924 accident cases, the students had been instructed in the hazards involved.

Conclusion. Students are warned of the hazards and taught in safety practices. The really progressive teacher, however, will consider most accidents as a challenge in an effort to find solutions. With this attitude on the part of the teacher the number of accidents can be further reduced. Effective safety learning is not only knowing what to do and not to do but putting this knowledge into practice. Thus accidents should be a challenge of effective teaching.

Table XII

SAFETY ENGINEERS

How many safety engineers signed accident injury reports?



Total.....1041

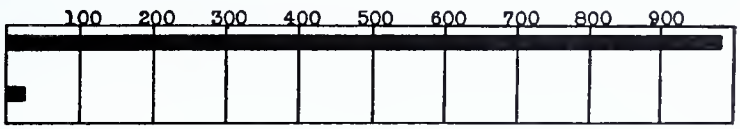
Discussion. The appointment of student safety engineers was not very common in school shops of Pennsylvania prior to the inauguration of this study. This question was asked only partially for the information desired but more particularly as a means of advocating such student organization. It is assumed that all school shops reporting accident injuries this year having safety engineers have had the safety engineer sign the reports. This organization is outlined in greater detail in Chapter VII.

Conclusion. The appointment of a student safety engineer for each class has been found to be an excellent method of teaching safety, and more particularly to be a means of reminding students of safety precautions and safety practices. It is in line with the school boy patrol plan, which has been very effective.

Table XIII

INSTRUCTOR IN THE ROOM

22. Was the instructor in the shop when the accident occurred?



Total 1041

Discussion. The question was included because of the fact that in past years there were a few school shop accident cases that attracted considerable public attention. One case led to lengthy litigation proceedings. Three injuries occurred on machines in the same shop in one year at times when the instructor was not in the room.

Conclusion. Relatively few accidents occur when the instructors are out of the shop. There should be exceptionally good reasons for an instructor to absent himself from a shop while students are at work there. In such cases someone, as for example a student fore-

*Number 22 in line one is an index number referring to a code number on the questionnaire. The table and the chart reads as follows: In 982 cases of shop accidents the instructor was in the room when the accident occurred, etc.

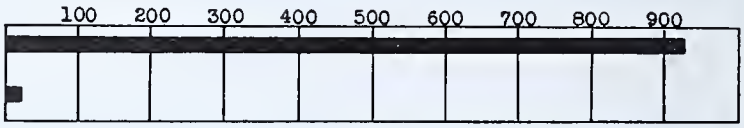
man, should be placed in charge. Some districts require, in such emergencies, that the instructor "pull" the main switch and lock the switch box until he returns.

Table XIV

GOOD HOUSEKEEPING

21. Was there good housekeeping?

Yes	926
No	9
No reply	106
Total	1041



Discussion. Practically all persons reporting indicated that there was "good housekeeping" in the shop when the accident occurred. In the nine cases which reported "no," the director of vocational education signed the reports.

It is difficult to get a true evaluation of whether the shop is "shipshape" when an individual has to pass judgment actually on something that he could probably correct.

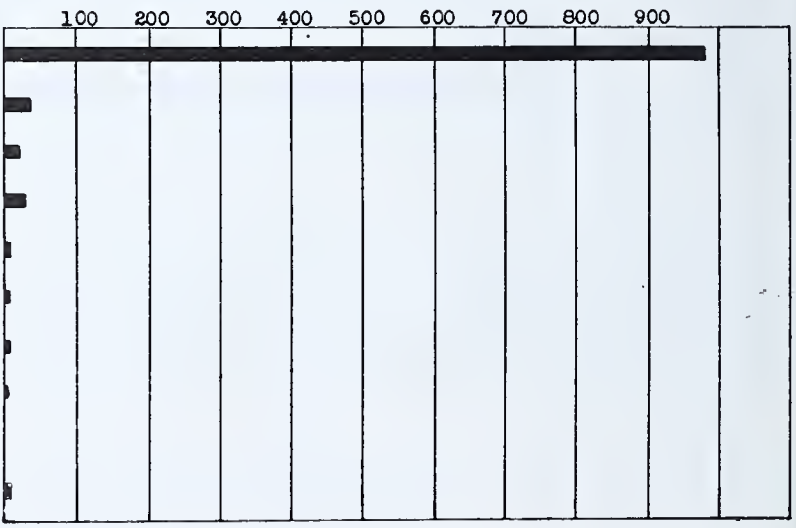
Conclusion. According to the findings, the school shops where these accidents occurred were generally orderly and well-kept shops. The number of falls, tripping, and cases of improper stacking of stock, etc., indicate, however, that there is room for improvement in this question of orderliness and care in a good "housekeeping" situation in the shop. It is known that loose blocks on the floor around wood-working machines have been the cause of a number of accidents.

Table XV

LOST TIME

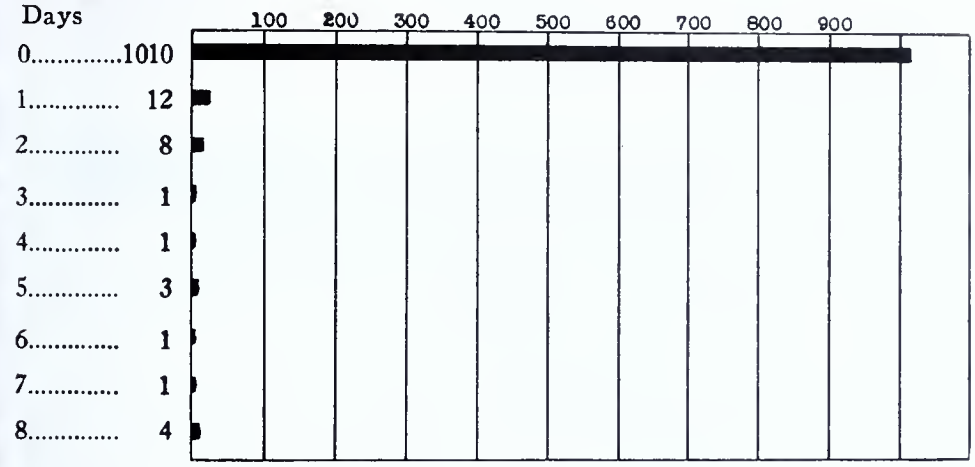
38. Hours

Hours	
0	984
1	17
2	14
3	16
4	2
5	2
6	2
7	1
8	0
9	3



*The number 21 in line one is an index number referring to a code number on the questionnaire. The table and the chart reads as follows: In 926 cases of school shop accidents reported it was claimed that "good housekeeping" prevailed.

39. Days



40. Months—No lost time reported by months.

Discussion. Districts were advised not to report as lost time any accident that caused the student to lose less than one hour.

Conclusion. There are relatively few accidents occurring in the school shops that necessitate losing time from work. Those cases which were severe enough to necessitate loss of time were sufficient to demand attention. Efforts need to be put forth to eliminate them too. The accident injuries not necessitating loss of time should not be under-estimated, particularly from the standpoint of the possible complications, which at times develop from insufficient care and treatment. Blood poisoning and numerous other complications have resulted from improper care of minor injuries.

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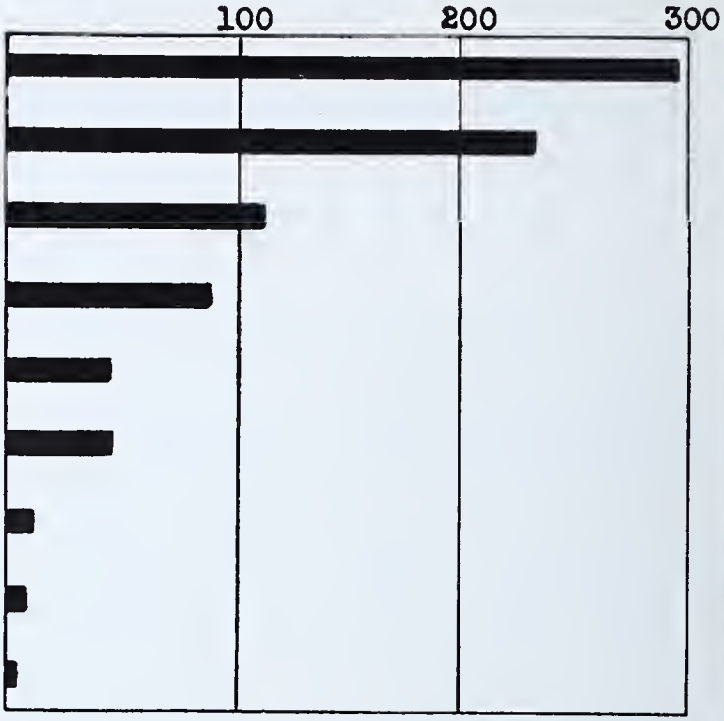
*The numbers 38, 39, and 40 refer to code numbers on the questionnaire.

Table XVI

SEMESTERS IN SHOP

41. Number of semesters in this shop.

Semester Injured	
1	299
2	231
3	104
4	89
5	43
6	43
7	11
8	8
9	2
No reply	211
Total	1041



Discussion. The number of accidents decreases with the number of semesters the boys are in the shop. The decrease is not quite so great as it might appear at first glance, since this study does not show the number of students exposed at these various semester levels. If we consider the fact that in a large number of school systems, industrial arts classes are required subjects usually for three years or six semesters and that trade classes are usually from two to four years in length, then these figures take on more significance.

Conclusion. A student does acquire safer ways of working the longer he is in a particular school shop. Safety instruction is effective in decreasing the rate of accidents the more semesters he spends in the same shop. The safety education emphasis should be the greatest the first semester in order that the new boys in the shop may become conscious of hazards and safe ways of working in their new environment.

*The number 41 in line one of Table XVI is an index number referring to a code number on the questionnaire. The table and the chart reads as follows: According to the reports 299 boys having injuries had spent one semester in the particular type of shop, etc.

Table XVII

TIME OF DAY INJURIES OCCURRED IN RELATION TO AGE OF STUDENTS

32, 33 Age
36, 37 Hour

Age of Student	Forenoon					Afternoon					Evening	No Time Reported	Total
	8	9	10	11	12	1	2	3	4	5			
10			1										1
11		3	1	2			1	2					9
12		4	4	3	2		3	4					20
13		7	8	19	4	2	11	11		2	1	1	66
14		13	27	18	6	15	22	12	3		2	2	120
15		19	63	41	10	27	59	13	1			8	241
16	1	14	65	42	6	31	45	10			1	6	221
17	1	11	38	31	8	19	37	10	1	2	1	5	164
18		4	28	14	3	8	23	11	1		1	2	95
19		1	6	10	1	2	6	1				1	28
20			1	2		5							8
21-27	1			3	1		1				4		10
Age not reported												58	58
Totals	3	76	242	185	41	109	208	74	6	4	10	83	1041

Table XVIII

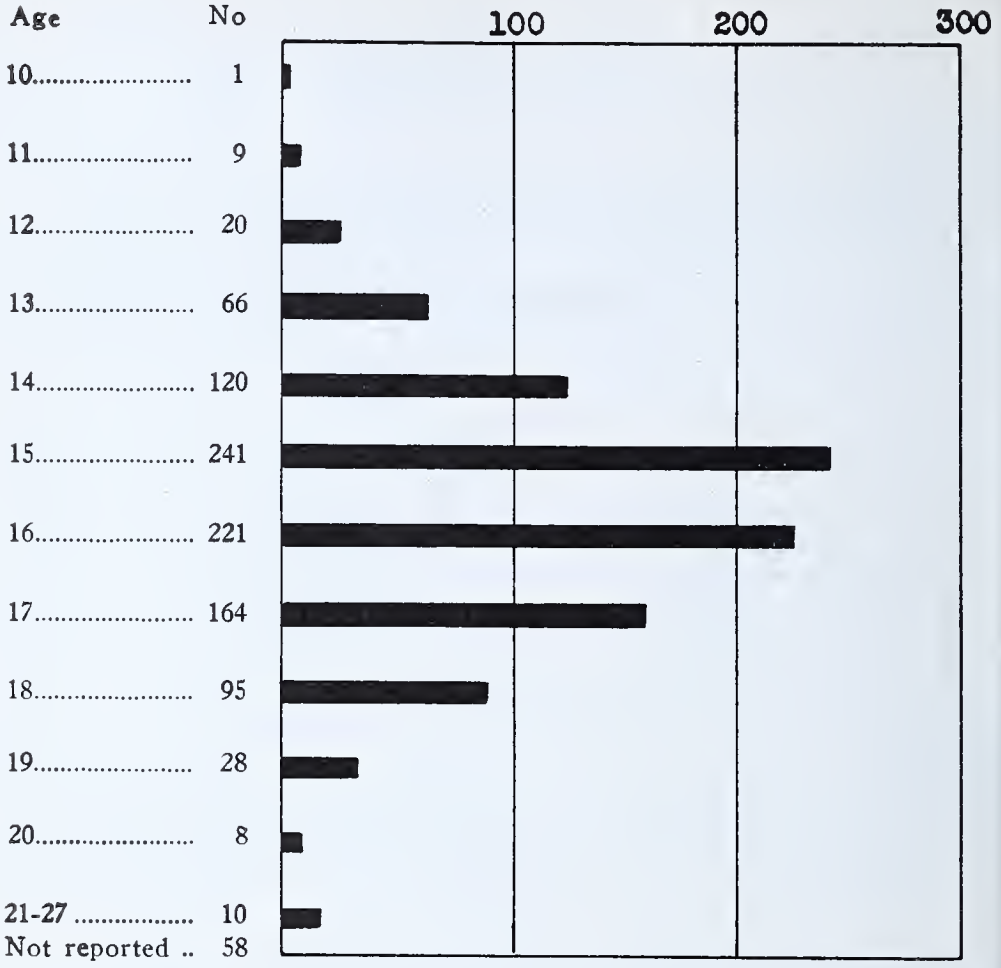
AGES OF STUDENTS INJURED

Discussion. Since most of the shop work begins in the seventh grade and normal yearly promotion would tend to make the age for this grade to be twelve years, those aged ten and eleven were ahead of their age-grade group.

The age of twenty-seven was the highest age reported to have had an accident.

Included in this study are 633 trade school students' accident reports whose ages range from fourteen years and up. Many schools will not permit the boys under fourteen or fifteen years of age to operate machines.

*The numbers 32, 33, 36, and 37 at the top of this table refer to code numbers on the questionnaire.



Conclusion. The fifteen and sixteen year old students have the highest accident records. These boys are both in industrial arts shops and trade shops. In comparing this study with "Semesters in shop" it will be noted that those students in a particular shop for the first semester or two had the highest number of accidents. Thus the students fifteen and sixteen years of age in a particular shop for the first or second semester, many of whom were learning to use machines, bring the records to such high places.

Stressing more safety instruction at these age levels will help to reduce this number.

Table XIX

HOUR ACCIDENTS OCCURRED

Discussion. The hour of 8 A.M. was interpreted to include the accidents occurring from 7:30 to 8:30 A.M., etc. There were 547 accident injuries in the morning and 501 accident injuries in the afternoon.

Conclusion. There is comparatively little difference between the number of accidents that occur in the forenoon and in the afternoon. Ten A.M. and 2:00 P.M. have the highest record of accidents in the morning and afternoon respectively.

Hour	No
8	3
9	76
10	242
11	185
12	41
1	109
2	208
3	74
4	6
5	4
Evening	10
No Reply	83
Total	1041

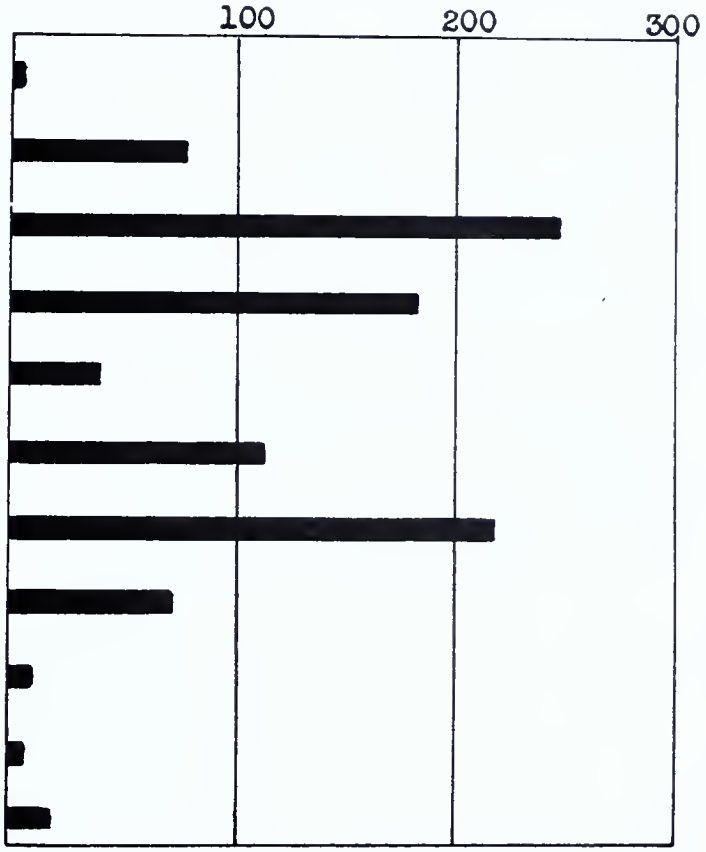
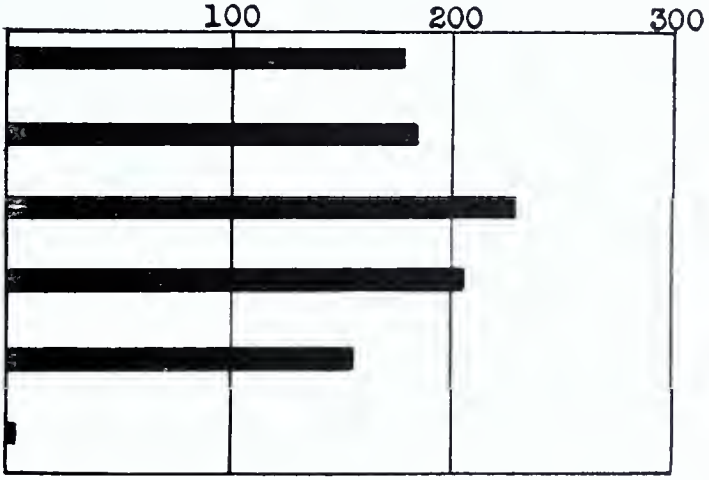


Table XX

DISTRIBUTION OF ACCIDENT INJURIES DURING THE WEEK

35. Day	
Monday	178
Tuesday	187
Wednesday	221
Thursday	201
Friday	165
Saturday	1
No reply	88
Total	1041



*The number 35 in line one of Table XX is an index number referring to a code number on the questionnaire. The table and chart read as follows: According to the reports 178 of the accidents occurred on Monday.

Discussion. Very few students are in school shops on Saturdays. Those that do work in school shops on Saturdays are often the more experienced and more capable students from an industrial standpoint. This accounts for the one Saturday accident.

The number of students in school shops from an exposure standpoint is practically uniform during the five school days of the week.

Conclusion. It appears that Wednesday is the most dangerous day of the week and that accidents tend to decrease toward either end of the week. Possibly in some future study someone will discover the reason for this .

Table XXI

DISTRIBUTION OF ACCIDENT INJURIES BY MONTHS

34. Month	
September	20
October	71
November	115
December	98
January	134
February	92
March	103
April	133
May	155
June	47
No reply	73
Total	1041

Discussion. The low number of accidents in September may be due to several reasons. While the districts reporting accidents were asked to report all the accident injuries from the opening and closing of school, the forms for sending in these reports were not sent out until October, and it is possible that many of the common and minor

*The number 34 in line one is an index number referring to a code number on the questionnaire. The table and the chart read as follows: According to the reports 20 of the accidents occurred in September, etc.

injuries were forgotten and were not reported. This is conjecture only. Other reasons might be that the school shops are seldom opened and put into full use until a week or two has passed following the opening of school.

February, the beginning of the second semester, had a relatively low number of accidents. Many schools closed by the end of May so that the number of accidents in June, if compared on a frequency rate of exposure, migh rank high.

Conclusion. The month of May, in this study, was the worst accident month. This was probably due to the haste and rush in trying to finish up projects before the end of the school year. This reason might also apply to the month of January, the close of the first semester of work. In the discussion of this table, reference was made to a number of factors which might have influenced the low number of accidents in September. It is safe to conclude, also, that greater stress is placed on safety at the beginning of the year and semester than at other times. This probably accounts, at least in a degree, for the relatively low number of accidents in September and February.

COMPENSATION AND LIABILITIES

The answers to these questions were prepared with the cooperation of state officials in Pennsylvania who are familiar with school law and are called upon for decisions regarding school matters

Compensation. The question is raised occasionally whether a student receiving an injury while pursuing his study, either in public school classrooms or shops, would be eligible for compensation.

The answer to this question is "No." The student is not employed but is a pupil in the public schools of the district. Therefore, he is not entitled to compensation.

Teachers are, however, protected by compensation insurance provided by the school board for all of their employes.

Liability. A school district is not liable for trespasses, negligence, and other torts committed by its officers and agents unless made so by statute. They have no funds out of which to pay damages, nor have they the power to raise money by taxation or otherwise to apply to such purposes.

A school board and their officers, however, have a moral obligation to see to it that machines are adequately guarded and that students are taught safe practices, also that teachers practice safety.

Chapter VI

Summary, Conclusion, and Implications

A STATE-WIDE INTEREST

This study was undertaken on the assumption that school officials and teachers were sufficiently interested in the elimination of school-shop accidents to make possible a study on a state-wide basis. The ready response to cooperate on the part of 153 school districts in every section of the Commonwealth and representing a wide range in population was an indication of their interest. Many others that could not readily cooperate indicated a genuine interest in the problem and its solution. Quite a number also failed to report because no accident occurred in their school shops during the year.

SIGNIFICANT CONTRIBUTIONS

1. This study tested out a state-wide interest in school-shop safety.
2. It serves as a sample procedure for a continuous study of school shop accidents.
3. A new and quite complete accident injury report form was developed.
4. New forms and definitions resulted from the study, which make possible more objective, more reliable, and more useful report data.
5. An analysis of the raw data indicates the range and frequency of the accidents in school-shops in 153 school districts in Pennsylvania in the school year 1933-1934.
6. Recommendations of tested ways and means for the elimination of accidents are set forth.
7. A number of districts have taken or are taking steps to organize safety programs which were stimulated through this study. A follow-up inquiry would be necessary to reveal the exact number.
8. Additional significant problems were discovered calling for further study.
9. This study enhances the possibilities of reducing accidents in school shops.
10. This study increases the possibilities of producing a new generation of safety-minded workers for industry.
11. The benefits to be derived are social, economic, and broadly humanitarian.
12. It contributes specifically to the conservation of human resources.

SOURCES OF DATA

The 1,041 reports of school-shop accidents were prepared in 153 school districts by the teachers in whose shops these accidents occurred. The reports were sent to the State Department of Public Instruction by the superintendent of schools or supervising principals. This study covered the school year 1933-1934.

Visits were made to many of the shops in order to supplement the information received through the written reports. A considerable time—approximately ten per cent—during a period of two years, was spent interviewing superintendents of schools, directors of vocationa

education, teachers, students, and safety men in industry as an additional background for this investigation.

The data were analyzed and recommendations were based on the findings.

STANDARDS SETUP

Safety standards are set up in Chapter VII, "Recommendations for a Safety Education Program" designed to be the basis for the elimination of accident hazards.

SAMPLE FORMS SELECTED AND DEVELOPED

Sample forms and features used in other studies and safety education campaigns are included in this report.

The unusual demand which necessitated the printing of 10,000 accident injury report forms indicates a wide interest in this form. It is believed to be quite complete and easy to fill out. Personal statements from teachers, directors, and superintendents indicate its acceptance in whole or part for future accident reporting.

NEW DEFINITIONS

New definitions used in this study were developed for accident injuries in school shops. The injuries were classified by severity, and the severity was defined.

Accident Injury Defined—Every mishap that causes injury to the body or member of the body should be considered as an accident injury.

Severity of Injury Defined—

Common—did not require first aid.

Minor—required first aid treatment only.

Severe—medical aid—stitches or setting bones, etc.

Serious—lost use of member of the body.

Critical—may cause death.

Death—occurred as a result of the accident.

New definitions were prepared which were based upon more valid measurement. Such measurement necessitated a quantitative statement of the number of accidents in terms of the possibility of accidents. The definitions are:

Frequency rate. Number of accidents per million student hours exposed.

Severity rate. Number of hours lost per thousand student-hours exposed.

A CONTINUOUS STUDY

A general interest in eliminating school-shop accidents will finally call for a common system of reporting, tabulating, and evaluating accident data. These data might well be summarized in each district. Much valuable information and interest would result from such continuous study and comparison on a state-wide basis.

SOME DIFFICULTIES ENCOUNTERED

The chief difficulty in this study developed in attempts to tabula the replies to (5) "Description of the Accident" and (7) "Descriptic of the Injury."

In at least seventy-five per cent of the cases, those reporting r corded the descriptions of the injury under "5" and the descriptio of the accident under "7." In other words, they were reversed ar reported under the wrong headings. It appears that the injury uppermost in the minds of those reporting and the nature of th accident secondary. The position of these two questions in the que tionnaire might readily be reversed for future use.

The difficulty of adequately describing accidents and injuries very apparent.

FUTURE STUDY SUGGESTED

Study the total situations which prevail in large numbers of acc dents so they can be more carefully analyzed, listed and coded facilitate more uniform and accurate reporting of both (a) the d scription of the accidents and (b) the description of the injuries.

Make an analytical study of the reported causes of accidents compared with those actually discovered to be the real underlyir causes in order to determine the reliability of the usual report ar modify reporting in the future.

Why does Wednesday, according to this study, have more acc dents than other days?

Conduct parallel group experiments to test out improved metho of teaching safety.

Safety involves an attitude of mind. How is "safety attitude" pr duced?

Does the teaching of safety under school auspices contribute a preciably towards the development of social-mindedness?

A FINAL DEDUCTION

It appears to be reasonable that if prospective teachers are pro erly taught safety, they, in turn, will instill in their pupils safe habits and ideals, which will significantly reduce accidents in scho and later in occupational life.

Chapter VII

Recommendations for a Safety Education Program

THE BASIS OF RECOMMENDATIONS

Recommendations for a corrective program should be based, as far as possible, on successful accomplishment, and upon a critical evaluation of changing conditions. Plans, procedures, and methods that have been tried out and yielded satisfactory results might well form the basis for recommendations. Recommendations should serve the needs of the situation, at least until better plans, procedures, or methods are discovered or evolved.

New situations and cases will arise for which no known satisfactory solutions have as yet been found. In such cases experience in dealing with problems somewhat akin should be given consideration in setting up tentative solutions.

These recommendations are based largely on tested experience in dealing with the problems involved. The satisfactory experiences of those who have made safety problems a special study were drawn upon largely in preparing the safety recommendations in this chapter. The success of most of these recommendations have been observed by the writer.

Consent to use these recommendations and suggestions has been very readily granted by each school district, department, or person concerned. Safety leaders regard it a privilege to make a contribution to the cause of accident prevention.

THE SOURCES OF THE RECOMMENDATIONS

The source of the recommendations were secured largely from:

(1) Harrisburg: **Safe Practices—Recommendations.** The Department of Labor and Industry, Commonwealth of Pennsylvania.

(2) Detroit: **Handbook of Safety Regulations.** Board of Education, City of Detroit, 1933.

(3) Lancaster: **Safety Standards and Recommendations for School Shops.** School District of Lancaster, 1934.

(4) Philadelphia: **Safety Standards and Recommendations for Use of Teachers of Shopwork.** Philadelphia Public Schools, Philadelphia, 1930.

(5) Pittsburgh: **Safety Requirements for Shops.** Pittsburgh Public Schools, Pittsburgh, 1933.

Most of the safety measures suggested in this chapter were carefully selected from the foregoing publications, thus adding the weight of tested experience to this study. In certain cases most of the pamphlets listed above contained suggested regulations. In such cases critical selections were made for the most appropriate safety measures.

GENERAL SAFETY RECOMMENDATIONS

ANGER: It is unsafe to permit any angry person to operate dangerous machine or work in a hazardous location.

ASK FOR INFORMATION: "When in doubt concerning the wor with power machinery ask for foreman or instructor." (2)[1]

BELTS: "Never attempt to stop a machine by grabbing a bel When replacing a belt, stop the machine and adjust it on th driver pulley first. When shifting overhead belts always use a stic reaching nearly to the floor. If an overhead belt is caught an begins to wind around a shaft, get away. Shut off the power in mediately. Metal belt fasteners must never be used on hand shifte belts. In shifting lathe belts by hand always use the palm, wit thumb and fingers extended." (2)

BURRED TOOLS: "No tools or stencils with mushroomed heac should be permitted in service. This applies to tools owned by th workers themselves as well as company tools." (1)

CAPS: "Persons working in shops around machinery which present a hair-catching hazard should wear caps or other types of hea covering. Caps should also be worn where there is danger of th hair catching fire. Caps with metal buttons or metal visors shoul not be worn around electrical hazards. Women working abou machines should wear caps at all times." (1)

CHECKING EQUIPMENT: "When accepting for use any equip ment examine it carefully and report any breaks or defects an thereby avoid possible accidents." (2)

CLEANING UP: "All rags, waste paper, bits of broken lumber, ex celsior, packing materials, and other inflammable debris should b cleaned up daily from under work-benches, from behind machine and from all other spaces. Such materials should be kept in sui ably covered containers. This would tend to reduce the amount t be cleaned up each day." (1)

"In all cases before students are permitted to clean up the machines the main power switch should be thrown out an locked." (2)

COURTESY: "Students should treat their shop mates with courtes and work in harmony with them." (2)

CROWDING: Crowded conditions should be avoided. Crowdin may be due to over-sized classes, lack of equipment, or to to limited floor area. Each student should have a working locatio A minimum of at least forty square feet per student is usual needed in the average shop. There may be other factors to consid under crowded conditions.

DEFECTIVE MACHINES AND TOOLS: Avoid using broke tools, splintered handles, improperly tempered tools, mushroom tools, improperly designed equipment, damaged or rotted ladde worn or rotted rope, etc.

DUST: "Dry sweeping in workrooms should be permitted on where there is no dust hazard or where the nature of the wo

[1]The numbers throughout this chapter refer to the pamphlets listed under "The Source the Recommendations."

performed precludes the use of other methods; otherwise all floors should be sprinkled with water before sweeping. The use of disinfecting solutions in the water is recommended. The practice of using damp sawdust or other wetted materials is acceptable in lieu of sprinkling water, especially around electric equipment where the use of water would tend to create a hazard." (1)

EXTENSION CORDS: "Separable connections should be provided on all extension cords for drills, drop lights, etc. Only super-service, heavy rubber covered cord should be used for all extensions. Extension cords should only be connected to wall outlets, never to lighting circuits. Whenever possible avoid the use of extension cords by arranging for permanent electrical installations." (2)

FALLS: Avoid using defective ladders and defective ropes. Set ladders at proper angles with a sure footing. Guard rails and foot boards should be provided for elevated positions in accordance with standards set up by the Department of Labor and Industry.[2]

FALLING OBJECTS: "Piling of materials should at all times be carefully done, being sure at all times to maintain the balance of the pile. Removing objects from a pile requires the same caution in maintaining balance to the remainder of the pile.

"Other contributory causes to falling objects follow:

1. Objects falling from trucks, wagons and cars which are not properly blocked or tied.
2. Tipping of hand trucks moved on or off elevators.
3. Transferring of objects by cranes, derricks or hoists. Proper selection of chains, rope-slings, hooks and other equipment is important.
4. During a lift everyone must keep out from under the object being lifted.
5. Jobs rolling to the floor from benches. Such jobs should be properly blocked.
6. Where blocks, jacks and horses of insufficient strength are used.
7. Throwing tools or materials to a fellow workman. They should always be handed to him or, if that is not possible, they should be placed in a suitable container which can be raised or lowered by a rope.
8. Leaving tools on the edge of high places where vibration or accidental striking may send them on their way to probable injury to some person." (3)

FALLING TOOLS: "Workmen working at elevated levels should not strew their tools about promiscuously. They should be carried in tool belts or kept in tool boxes when not in actual use. The practice of throwing tools from one level to another should be discouraged. They should be raised or lowered with light ropes or passed from hand to hand. The practice of working above unsheltered workmen should be actively discouraged at all times.

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[2] *Railings, Toe Boards, Open-sided Floors, Platforms and Runways.* Harrisburg: Department of Labor and Industry.

"Never pile or lean tools or materials against anything. The may fall or be knocked down and injure someone." (1)

FEEDING STOCK TOO FAST: "Improper speeds and feeds machines may be dealt with by posting conspicuously speed ar feed charts and requiring the pupil to use only the speed or fee indicated for the work he has in hand." (3)

FOOTWEAR: "**Shoes with Good Soles.** For normal shop wear sho with unbroken soles and low or medium height broad heels shoul be used. Where there is a possibility of heavy objects dropping o the feet, the toes should be boxed or reinforced." (1)

"**Special Shoes.** For hazardous occupations such as the handlin of hot metal, acids, caustics, electric current, and hot substance or other objects offering a burning hazard to the feet, special adapted types of footwear are available and should be worn." (1

GUARDS: "No person or persons shall remove or make ineffectiv any safeguard, safety appliance, or device attached to machine or guarding a hazardous condition except for the purpose of im mediately making repairs or adjustments; and any person or pe sons who remove or make ineffective any such safeguard, safet appliance or device, for repairs or adjustments, shall replace th same or its equal immediately upon the completion of such re pairs or adjustments. (Section II, General Factory Laws.) (1)

GOGGLES: "Goggles or other forms of head and eye protectio should be worn during the performance of all operations involvin hazard to the head or eyes." (4)

"Goggles must be worn while working at grinders, shapers, an while welding, chipping, pouring metal, and when lighting fu naces, even though the operation may take only a moment. Flyin chips from cutting tools and sparks from grinding operations hav caused many serious injuries." (2)

HANDLING STOCK: Special care should be taken in handlin stock. Splinters and metal-cut accidents are numerous. These a due largely to sliding stock through hands or to failing to faste stock securely while working on the same.

HASTY WORK: Haste should be avoided in school shops. Speci warning safety precautions should be taken and haste avoided th last month of each semester when accidents are most numerou

HAND TOOLS:

a. Adjustable wrenches should always be used with the jaw facing the direction of pull thereby eliminating slippage whi in turn produces the skinning or mashing of knuckles.

b. Correct tools for every job should always be used, as per t following suggestions:

   1. Machinist hammers should not be used as carpenters ha mers and vice versa.
   2. Screw drivers should not be used as or for chisels.
   3. Wrenches should not be used for hammers.
   4. Pliers should not be used where a wrench is needed.

5. Soft metal hammers of lead, rawhide or copper should be used on tempered tools such as drills, reamers, jigs, and fixtures, thereby preventing possible injury from flying chips of hard steel.
6. Pliers, taped or not taped, should never be used on live electric circuits.
7. Tongs or special holders should be used when holding bull chisels.

c. When finished using hand tools always put them to their proper place. Never leave them lying around where someone can trip over them or on a shelf where they can fall and injure someone.

d. Hand tools should always be kept in the best of condition as follows:

1. Mushroom heads on cold chisels and hammers should be dressed immediately.
2. Hammers must have good handles and tight heads at all times.
3. Pipe wrenches should always have sharp jaws.
4. Tools having slivered or splintered handles should be repaired at once with new or smooth handles.
5. Screw drivers and files should have well-kept handles." (3)

HANDLES: "Wooden handles of hand tools should be of the best straight-grained material.

"Wooden handles which have been excessively burned or worn, or which are cracked or badly splintered should be removed from service." (1)

HOUSEKEEPING: "**Placing of Tools.** Tools laid aside temporarily shall be placed in positions which will not endanger other persons in the shop. (2)

"**Placing of Materials.** Do not store material or tools on the floor, nor temporarily leave them on the floor to cause stumbling hazards, nor on unguarded overhead trestles or platforms from which they might fall. (2)

"**Removal of Chips.** Chips should be removed from the machine with a brush or hook. Do not use your fingers, waste, or cloth. (2)

"**Oily Waste and Rags.** Put oily waste or rags in the closed metal container waste cans provided for the purpose to avoid fire hazards. (2)

"**Cleanliness.** Shavings and waste material are to be removed from the school shops and laboratories at the close of each day's session. Teachers can cooperate with janitors by keeping all cabinets, shelves, tables, desks, and corners clean. Piling stock on the floor should be avoided." (2)

HORSEPLAY: Fooling (horseplay) in shops should be eliminated.

ILLUMINATION: Sufficient, non-glaring light should be furnished in all working areas, in stairways, and storage spaces. Light should be placed particularly carefully at machines.

INATTENTION: "When a learner is operating any machine, co versation between the learner and any other person should prohibited. If instructions are necessary, the machine should stopped." (4)

KEEN-EDGED OR POINTED TOOLS: "**Direction of Cut.** Ca should be exercised in the use of adzes or draw knives to insu that no part of the body is close enough to the point being work on to be endangered by a slip of the tools. When cutting with hand knife, the direction of the cut should always be away fr the body. (1)

"**Manner of Carrying.** Keen edged or pointed tools, such as ax hatchets, adzes, saws, knives, chisels, bits, lineman climbers, similar tools should not be carried in a manner which endang the bearer or persons passing him. Do not carry a long scr driver or other pointed tool projecting from your pocket." (1)

LEGGINGS: "Protective leg covering (clothing or devices) sho be worn when handling hot metal, acids, caustics, or other hot cold substances offering a burning or scalding hazard. The m terial of which they are made should be determined by the natu of the product being handled. Full length leg or body protecti should be used if the nature of the operation presents a full leng leg or body hazard.

"Fastenings. The method of fastening all-protective leg cov ing should permit of instantaneous removal." (1)

LEANING ON MACHINES: "Do not lean on a machine while is in operation. Keep at a safe distance from all moving parts."

LOOSE CLOTHING: "Superfluous material and loose fitting clo ing should be avoided in the presence of a hazard from mov machine parts. Excessively wide or long aprons should not worn around moving machinery. Aprons should never be tied with wire and should be but lightly secured, so that they can easily torn loose by hand. In the presence of a fire hazard apr of nonflammable material should be used. (1)

"Articles of wearing apparel or personal adornment, includ spectacle rims, collars, eye shades, or cap visors, composed pri pally of some form of cellulose should not be worn in the prese of a spark or fire hazard." (1)

MACHINE OUT OF ORDER: "Lock the switch or hang an " of order" sign on a machine that is out of order." (2)

MATCHES: "Matches shall be stored in closed glass, earthenw or metal containers and be in the personal charge of the teac Only safety type matches shall be used." (2)

OBSOLETE EQUIPMENT: "Obsolete equipment which cannot brought up to present safety standards should be discarded."

OILING MOVING MACHINERY: Avoid oiling machinery w it is in motion.

OILY WASTE: "Grease, oil, or paint soaked rags, waste, or o materials of like character, many of which are subject to sp

taneous combustion, shall be kept in approved self-closing metal receptacles. These receptacles shall be kept safely clear of combustible surroundings and their contents shall be safely disposed of at least once each day." (2)

OPERATING A MACHINE: "When a student operates any of these machines, no other person but the instructor shall be allowed inside the line. No one outside the line shall be allowed to talk to the student operating the machine, except in case of emergencies. The helper to the boy feeding a print press is an exception to the rule." (2)

OPERATING ZONES: Safety zones for the operator should be established around each machine operator's location. Painted lines on the floor prove satisfactory. Operator's spaces painted with a paint including an emory grit are very satisfactory. Corrugated rubber mats if fastened securely to the floor at the operator's position provide an added safety measure.

PERMISSION TO OPERATE MACHINES: "Never operate a machine unless permission has been given by the instructor." (2)

PILING SAFELY: "**Piling.** All material needing to be piled should be carefully piled to prevent falling. When piling material near travel-ways, special care should be exercised to eliminate any possible hazard from piles being knocked over. Piles should not extend into travel-ways. (1)

"**Light.** Piles of material should not interfere with the adequate distribution of natural or artificial light. (See Regulations for Industrial Lighting for intensities required.) (1)

"**Height and Extent.** Material should not be piled to a height which would render the pile unstable or which would interfere with the operation of a sprinkler system. Piles should not be placed so close to equipment as to hinder operators in the proper operation of their machines or expose them to hazard from slides or falls of material. (1)

"**Binding.** Wherever possible the stability of piles should be increased by piling alternate layers crosswise, or, in the case of long piles, by crisscrossing at the ends or using binder strips. (1)

"**Round Objects.** Should be carefully blocked at the center and at both ends to prevent spreading." (1)

PROJECTING SET SCREWS: "Avoid use of projecting set screw heads on revolving parts." (2)

PROPER FOOTING: "When working around any machine, be sure good footing is provided." (2)

POURING METAL: "Approved leggings, shoes, and goggles must be worn during pouring operations in the foundry, by all persons who are pouring or otherwise exposed to the danger of burns from the spilling or splattering of molten metal. Be sure that the mould is perfectly dry, to avoid spattering." (2)

SAFETY HABITS: "Students should endeavor to acquire habits of caution for their own protection and that of their shop mates.

They should cultivate careful, thoughtful, and deliberate habits work and develop a 'safety conscious' attitude of mind." (2)

SAFETY ZONES: (See operating zones.)

SLEEVES ROLLED: "Students are to have sleeves rolled to th elbows and loose hanging ties so arranged as to prevent entangl ment, while working on revolving machines." (2)

SHARP-EDGED SCRAP: "All objects with sharp edges, such a scraps of glass, tin, sheet metal, and the like should not be throw into the wastebasket or other containers ordinarily used for oth debris, but should be placed in separate containers. Neither shou such material be permitted to remain on floors except during o erations normally resulting in its creation. In the latter case, co tainers should be provided to catch such waste material as it dro from machines or benches and the floors should be frequentl cleaned up each day to prevent undue accumulations." (1)

SHARP TOOLS: One of the safety measures to be adopted in a shops should be to keep all tools sharp. Dull tools are dangerou This is particularly true of dull circular saws.

SLIPPING HAZARDS: "Puddles or drippings of oil, grease, wate or other liquids should be rendered harmless by mopping up ar strewing sand or sawdust on the floor until the floor is dry. O soaked sawdust should be disposed of promptly to prevent spo taneous ignition. Drippings on floors should be prevented by elim nating the cause or by placing drop pans in position until the cau has been eliminated."

SUPERVISION: "Proper supervision is probably the best accide preventative at the command of the shop teacher. With the prop shop organization the instructor should be able to spend near all of his time moving about the shop, constantly observing th progress of all operations, both from the standpoint of proficien and safety. Proper supervision is not achieved from a desk." (

STAND CLEAR: "Form the habit of never standing in line wi swiftly revolving parts, such as grinding wheels, pulleys, saw and jointers." (2)

STARTING MACHINES: "Before throwing on power always e amine carefully, to make sure every part is in working order. possible move a machine by hand to be sure all moving parts a free before throwing on the power." (2)

STOP: "Always stop a machine before cleaning, oiling, adjustir or setting cutting tools." (2)

STOCK HELD INSECURELY: Stock should be fastened in t vise securely or clamped down to avoid a large number of accid injuries.

STOCK TOO SHORT: Avoid machining short stock. Let each sh establish a minimum length. Twelve inches is a commonly- cepted minimum length.

STORING TOOLS: "No hand tools should be permitted to lie on the floor, ground or working platform when not in use for any length of time. They should be kept in the proper receptacles or storage places. Axes, hatchets, adzes, or knives should be placed in receptacles provided for the purposes. For temporary purposes only, the cutting edge of the tool should be driven into a flat in places where persons will not trip over them or else lodge vertically in corners or racks where they timber far enough to hold the tool in an upright position." (1)

STRIKING HAND TOOLS: "Hand tools should always be struck with wooden, soft metal, rawhide, or rubber hammers or mallets if the part receiving the blow is case hardened or tempered. Such hammers or mallets should also be used where inflammable or explosive gases or vapors are present. Sheets of brass or other soft metal may be used to receive blows, but should not be battered to an extent which would create a hazard of flying particles. Hand striking tools which show any signs of cracking should be removed immediately from service.

"Hammers and hatchets with corrugated driving faces for driving flat-headed nails should not be used for driving brads or nails with rounded heads, because of the increased hazard of flying nails.

"Do not use a machinist's hammer for driving nails, and do not use a carpenter's hammer for machine work." (1)

TAKING CHANCES: Chance-taking results frequently in accidents. It should be avoided.

TEACHER PRESENT: "Machines should be operated only when the teacher is in the shop. Main switches in the shop should be pulled and door on panel box locked whenever the teacher leaves the shop." (4)

TRAVEL ZONES: "Loose-board material and other objects or materials should not be permitted to remain strewn haphazardly on the floor or ground in places where persons have to walk or work, but should be piled up neatly. No loose material of any description should be permitted to remain unsecured in any overhead position." (1)

"Aisles should be established by painting clear white lines indicating their location and keeping these aisles clear of any and all material or equipment." (3)

TIRED AND MENTALLY FATIGUED: Ill health, worry, lack of sleep, dissipation, over-work, etc., cause sluggishness. Those afflicted cannot give strict attention to their work.

TURNING ON POWER: "Instructors will personally see that the power switch at every machine is released before the main power supply is turned on. When starting power machinery or throwing on electrical current, instructors should always caution students to 'stand clear of machines'." (2)

UNDIVIDED ATTENTION: "When operating a machine students should give their undivided attention to the work." (2)

UNSAFE PROCESSES: Certain processes are known to be dange ous or risky. These should be avoided.

VENTILATION: Improper ventilation, fumes, and suffocati gases need to be eliminated. This needs to be cared for partic larly in auto shops, foundries, etc.

WORRY: "Worry prior to an accident is extremely difficult to d tect but close observation of pupils at the time assignments a made is essential. Having determined that a pupil is worryin two courses are open to the instructor: first, if possible remo the cause and second, if this is not possible then remove the pup from any dangerous contacts." (3)

WRENCHES: "All wrenches should properly fit the nuts, bolts, other objects they are used to turn. Except when closed wrench are used, the practice of using thin pieces of material as shims make oversize wrench fit should not be permitted. Always put wrench on the right way so that you do not spread the jaws a cause it to slip.

"Wrenches should not be used as hammers." (1)

SPECIFIC SHOP SAFETY RECOMMENDATIONS

Automotive Shop[3]

AUTO MECHANICS:

Removal of Gasoline:

All gasoline must be drained off before an automobile is brough into the shop, except in cases where special permission has bee granted.

Draining Carburetor:

The carburetor of an engine must be run dry outside the buil ing before the car is brought into the shop.

Running an Engine:

Running a gasoline engine inside a school shop is not to be a lowed under any conditions, except when special permission h been given by the fire marshall concerning such shops as ha specially constructed vents to the outside of the building.

Storage of Gasoline:

The storage of only one gallon of gasoline in an approved co tainer is allowed in an auto shop.

Disconnect Battery:

Before working on the power plant of a car, disconnect the ba tery and insulate connections.

Fire Protection:

In case of fire about a machine or from spilled gasoline, smoth out the flames with the fire extinguisher provided. If no e tinguisher is at hand, use wet rags or wet sand.

[3]Many of the general safety recommendations also apply to the automotive shop as w Here are listed those recommendations applying only to automotive shops. All of these rec mendations appear in *Handbook of Safety Regulations.* Board of Education, City of Detr 1933.

Charging Battery:

Before taking battery off "charge," throw off charger switch and then disconnect battery.

Burns from Engine:

Many severe accidents result from contact with exhaust pipes, manifolds, and other portions of engine while hot.

Hot Water and Steam:

Use great care in draining radiators, removing radiator caps, and removing hose connections to avoid burns from hot water and steam.

Grease and Oil:

Keep the floor free from grease and oil.

Creepers:

Keep creepers off the floor when not in actual use to prevent accidental tripping.

Blocking:

When removing and replacing axles, frames, springs, and such units, a jack of an approved type should be used and the machine should be properly blocked. The blocking must be carefully inspected by the instructor.

Mounting:

When working on heavy units see that they are securely mounted on substantial blocks or horses.

Chain Hoists:

Be sure that all chain hoists are securely fastened to a substantial horse or other fixture.

Cranking:

In cranking an automobile engine—

1. See that the engine is in neutral and the spark retarded.
2. Stand a little back from the crank in an easy position.
3. Avoid straightening the arm at the elbow.
4. Keep the thumb on the handle of the crank next to the forefinger.
5. Avoid spinning the motor.

Electrical Shops and Laboratories[4]

1. No electrical apparatus is to be worked "HOT" unless under personal supervision of the instructor.
2. All test lamps must be 220 volt.
3. Fans, projecting set screws, and gears on motors under test must be adequately guarded before power is turned on.
4. Moisture on molten metal will cause a violent explosion, which might result in the loss of eyes. Never pour any metal until

[4]Many of the general safety recommendations also apply to the electrical shops and laboratories. Here are listed those recommendations applying only to electrical shops taken from *Safety Standards and Recommendations for School Shops.* School District of Lancaster, 1934.

everything has been inspected by the teacher, and then on
under his immediate supervision.

5. Do not leave a hot iron or soldering copper where someone ma
pick it up or step on it. Mark it"HOT" with chalk if it cann
be put out of harm's way.

6. Be careful that soldering fluxes and acids do not get into th
eyes or on the clothing.

7. Never attempt to test a leaking gasoline torch or any gas co
nections with a lighted match.

8. If clothing becomes ignited, do not run, but lie down and ro
over and over, or wrap something around you to smother th
flames.

9. Turn off the main current to the battery charge or lamp ban
when putting on or removing a battery from the charging lin
The gas from a charging battery is explosive and easily ignite
from a spark.

10. No open flames should be brought near a freshly charged ba
tery. If lead burning must be done on a battery, have the i
structor check over and blow the gas from the battery to guar
against an explosion.

11. Never stand over a battery while working on it. An explosio
may blind you by thrown acid.

12. Never pour water into strong sulphuric acid while diluting
for electrolyte. Pour the acid into the water slowly.

13. Baking soda is a good neutralizer of battery and other acid, an
it may be applied directly to the skin without danger.

14. If you have occasion to work on a battery in a car never wor
directly under it. The corroded parts or dust would be ver
injurious if they fell into the eyes.

15. Wear rubber gloves when working around battery acid.

16. Never cut into a wire or open a switch without guardin
against the possibility that a heavy current if flowing migh
cause a serious burn.

17. Never throw in a switch or insert a fuse until you are SUR
the line is clear from one end to the other.

18. When working on a circuit always be sure that the switch
pulled or the fuses are out.

19. Always use a caution tag on any circuit which you may
working on.

20. A student must NOT, under any condition, cause another st
dent to be shocked. Remember that low voltages may be da
gerous to certain people.

21. Never cut two wires at the same time. It may burn up yo
cutting instrument, also cause a severe burn.

22. Do not deliberately short circuit any electrical circuit or generating device. It will cause a bad flash.
23. Never short circuit the terminal of a storage battery. It may explode. Use the proper instruments provided for this purpose.
24. Always test line voltage before inserting any electrical device.
25. Treat all unknown wires as "HOT" wires. Always play safe.
26. Never substitute anything else for a fuse of the proper size. Remember a fuse is a safety valve. This should be demonstrated by the instructor.
27. Do not handle portable electrical tools while you are in a damp or grounded location unless the tool frames are connected to a ground.
28. Electrical appliances such as heaters, toasters, percolators, etc., should NEVER be handled when you are in a damp or grounded location.
29. Do not operate electrical apparatus while holding tools or other conducting apparatus in the hand.
30. Do not use metal rules around electrical equipment.
31. Do not handle anything on the switch board without the permission of the instructor.
32. Never change a circuit on a distribution panel unless you are doubly sure that there is no load on that circuit.
33. When working close to a "HOT" circuit which is exposed, always cover it with a rubber cloth or some other good insulating material.
34. Do not lay or drag lamp cord or wire on a metal pipe or on a sharp edge.
35. Do not forget to shut off the current of a heater, flat-iron or soldering copper when you are through using it or when you want to leave it for a short time.
36. Never watch an electrical arc. The rays will burn the eyes.

Foods[5]

1. **Loose Clothing.** Make some arrangement by means of which loose clothing will not come in contact with flames.
2. **Oily Mops.** Oily mops should not be kept in confined places, such as in small closets, metal cans, etc., but should be kept in places where there is adequate ventilation to prevent their ignition by spontaneous combustion.
3. **Pot Handles.** Be sure that no pot handles project beyond the edge of the stove or table where they might be easily upset and cause severe burns.

[5]Many of the general safety recommendations also apply to the foods laboratories as well. Certain classes in foods are taught as trade classes. All of these recommendations are taken from *Handbook of Safety Regulations.* Board of Education, City of Detroit, 1933.

4. **Tea Kettle Spouts.** Be sure that all tea kettle spouts are point toward the center of the stove, in order to prevent scalds.
5. **Lighting Gas Appliances.** When lighting gas appliances of a kind always light the match first and place it near the burn before turning on the gas.
6. **Gas Leaks.** If an odor of gas is detected at any time do not a tempt to locate it with a lighted match or other open flam Open the windows and doors of the room to secure adequa ventilation and call for the repairman.

Forge and Foundry[6]

1. Hardened tool steel should never be struck with hardened to steel, such as a hammer against the face of an anvil or a ha mer against a file.
2. Never harden the end of a chisel or punch on the blunt end.
3. Use goggles in heavy forging.
4. Use only hammers with handles securely fastened.
5. (a) Avoid standing in line with the swing of anyone's ha mer.
   (b) Never swing a sledge in line with anyone. First see th you have proper clearance.
6. Be sure tongs are fitted to the work before forging.
7. In cutting off stock or rivets see that no one is in line with t direction in which pieces may fly.
8. Hot metal pieces on the floor should be marked "hot" wi chalk so that no one will be badly burned.
9. Keep anvil face clean of scale.
10. When forging be sure to place tongs directly over the wo This will insure safety from flying hot metal.
11. When putting work into or taking it out of the forge be su to shut off the blast.
12. Do not offer work to be inspected unless you are certain th it is cold.
13. When plunging hot iron into tempering oil stand clear o possible flare up of oil.
14. Remove all fire hazards such as oil waste or rags which m be in your overalls or near the forge.
15. When case hardening using cyanide, do not breathe the fum They are highly poisonous.
16. When using sand to bend tubing be sure that it is absolut dry.

[6]Many of the general safety recommendations also apply to the forge and foundry shops. of these recommendations were taken from *Safety Standards and Recommendations for Sc Shops.* School District of Lancaster, 1934.

17. Do not light a gas flame or torch when anyone is standing near the source of the flame.
18. Very serious accidents have resulted from compressed air cleaning hoses. Never touch anyone with the air nozzle. Be careful in blowing down a machine to avoid driving a particle in someone's eyes.
19. Never lay down a burning gas brazing torch. Turn it off immediately.
20. Moisture in molten metal is liable to cause a violent explosion which may cause serious burns or loss of eyes. Do not pour any metal until everything has been inspected by the instructor and only under his immediate supervision.
21. Do not leave gas flames burning or unlit gas turned on.
22. No tanks which have contained gasoline or other explosive liquids are to be soldered, brazed or welded by any pupil.
23. Never attempt to test leaking gas connection with a flame or lighted match.
24. Crucibles should be inspected by instructor before pouring.

Machine Shop[7]

Engine Lathes:

1. Starting a Lathe—If there is any operating knob or lever the operation or function of which is not understood, investigate while the lathe is being slowly turned over by hand. Test all feeds before turning on power.
2. Oiling Lathe—Neither the lathe nor the counter-shaft should be oiled while the machine is in motion.
3. Spindle Turning—In spindle turning, take care that the tail stock is firmly clamped before starting.
4. Setting Tool—For slender pieces, especially of brass or of composition metal, set the cutting tool on center and never above.
5. Stop—Be sure to stop lathe before taking job from center or chucks.
6. Running Gears and Lead Screws—Never touch a running gear and keep clear of a rapidly running lead screw, if it has a longitudinal key way.
7. Throwing in Back Gear—Do not throw in back gear while the machinery is running.
8. Polishing and Filing—When polishing or filing, look out for the lathe dog or any projecting parts of the machine or work. Learn to file left-handed. Use a file provided with a handle.

[7]Many of the general safety recommendations also apply to the machine shops as well. All f these recommendations appear in *Handbook of Safety Regulations.* Board of Education, City f Detroit, 1933.

9. Carriage Lock—Be sure the carriage lock is not set wh throwing in the transverse feed.
10. Oiling the Counter-Shaft—Keep the countershaft well oil to prevent the lathe from starting when the clutch is o
11. Feeds—When using either lead screw or friction feed, sure the other feed is out.
12. Clamping Nut—When changing to or from back gear, sure the clamp nut is in place and tightened.
13. Chucking—When chucking work, never leave the wrench the socket, except when actual adjustment is being mad Serious accidents may result if the wrench is left inadve tently in the socket.
14. Face Plate—Do not put on or remove a chuck or face pla when the spindle is being driven by power.
15. Fastening Chuck—The chuck should always be screwed firmly against the spindle shoulder so that, if the lathe reversed, the chuck will not unscrew and fall off, doing po sible harm to the operator and the lathe.
16. Reversing Heavy Chucks—A heavy chuck is apt to becor unscrewed and fall off if the lathe is not brought to a co plete stop before being reversed.
17. Fastening Work—If the work is held in a chuck or on a lar face plate, be sure that the work is securely fastened befo turning on the power.
18. Balanced Work—Heavy and rapidly revolving pieces shou be carefully balanced.
19. Leaving Lathe—When a job is finished, throw out all fee and do not leave the tail stock offset, or the taper attac ment fastened in place.
20. Cleaning Lathe—Take pride in keeping your lathe clean. good mechanic always leaves his machine wiped clean a in first class order.

Drill Presses:

1. Starting a Drill—Before starting a drill press, be sure t table and head are clamped and that the automatic release set to throw off the feed before the drill can injure the tab
2. Fastening Work—Work should be held by a vise or clam and safety stops should be placed in the table, to prevent t work from tearing loose.
3. Feeding of Drills—Feed drill slowly and cautiously, partic larly when it is breaking through the piece.
4. Slipping of Drill—If drill slips in the chuck do not atten to tighten it until the spindle stops. Under no circumstan strike a drill, chuck, or socket with a wrench or steel ha mer. Use a lead hammer or a piece of wood.

5. Removing Drill—Always remove a drill or chuck with a drift, and do not allow either to fall.
6. Removing Chips—Use a stick or brush to remove chips from rapidly revolving drills. Never use waste or rags on any drill press operations.
7. Chuck Wrench—Never leave a chuck wrench in a drill chuck.
8. Adjusting Table—Do not raise or lower the table when the drill is in motion.
9. Drill Caught—Do not attempt to stop a revolving piece of work in which the drill is caught. Shut off the power.
10. Drilling Large Holes—In drilling large holes, always clamp work securely to the table and use stops to prevent the work from tearing loose and causing injury.
11. Back Gears—Do not throw in back gears when power is on.
12. Deep Drilling—When the drill has entered work before the flute, withdraw it, and remove the chips frequently.
13. Automatic—Never throw on the automatic feed until the drill is started in the hole.
14. Position in Drilling—In operating drill presses, do not lean over so far as that the hair or clothing may be caught in the belt or in a revolving spindle.

Milling Machines:

1. Starting a Cut—Make certain that the work is held securely, and that the cutter is properly clamped on the arbor before starting a cut.
2. Arbor Nut—Do not remove or tighten arbor nut by power of the machine.
3. Regulating Cutting Oil—Never reach across a revolving arbor to regulate the flow of the cutting compound.
4. Wiping of Chips—Use a brush on the off side to wipe chips from a revolving cutter. Never use the fingers, waste, rags, or a steel rule for removing chips or oil from any milling machine while it is in motion.
5. Automatic Feed—Be sure automatic stops are set and that everything will run clear during the ENTIRE CUT before throwing in automatic feeds.
6. Back Gears—Stop the machine before throwing in back gears.
7. Cutting Speed—Do not run a cutter at too high a speed.
8. Releasing Feeds—Never leave a machine without releasing all automatic feeds.

Shapers and Planers:

1. Clearance—To make sure the tool and head clears the ho ing and work, turn over the shaper by hand before starti
2. Setting Vise—When using the vise be sure it is clamped a cannot swivel, before starting a cut.
3. Changing Stroke—After changing length or position stroke, be sure to tighten the ram.
4. Cutting Stroke—Unless something is wrong, do not shut the power during a stroke.
5. Feeds—Always feed on the return stroke.
6. Adjusting Tools—Never attempt to adjust or remove a t while the machine is in motion.
7. Changing Back Gears—Never change the back gears wh the machine is running.
8. Position of Operator—Keep your head out of line of shaper ram.
9. Starting a Planer—Before starting a planer, be sure the wo will clear the cross rail and housings and that the pla clears everything at the extreme point of travel.
10. Safety Dogs—Place safety dogs at the end of the pla platen to prevent its running off the ways.
11. Shifting Dogs—Do not shift a dog during a stroke.
12. Planer Table—Never ride on the planer table.
13. Position—Under no circumstances place yourself where could be caught between the cross-rail, the ram, the housi and the work. Never place yourself in a position to be cau between the platen and the bed.
14. Leaving Machine—Before leaving the machine throw out feeds, shift belts on idlers, or gears in neutral position lock shipper handle.
15. Shipper Handle—If a shipper handle cannot be locked, not attempt to set up work or repair machine unless po is shut off.

Print Shop[8]

Drives:

a. All drives (belt-gear-chain-coupling) shall be guarded in approved manner.

Job Press:

a. An approved platen guard shall be provided for each press
b. A flywheel guard of approved type shall be provided for e press.
c. A guard shall protect all exposed shaft ends.

[8]Many of the general safety recommendations also apply to the print shop as well. A these recommendations appear in *Safety Requirements for Shops*. Pittsburgh Schools, burgh, 1933.

Proof Press:

a. If press is of the rack and pinion type, a sheet metal guard shall be provided to prevent fingers from being pinched.

Cutter:

a. The proper balance between handle bar and counterweight shall be maintained at all times.
b. A guard shall be placed around the counterweight to prevent toe hazard.
c. Extreme points of knife extending beyond housing shall be guarded.

Note: Suggestions from instructors for the safeguarding of the knife will be welcomed by the Department.

Sheet Metal[9]

a. Stakes:
   1. Carefulness in handling most important.
   2. Watch out for sharp pointed ends.
   3. Keep clean—and in a definite place.

b. Solder:
   1. Be careful—it may be hot.
   2. Watch for jagged, pointed ends.

c. Soldering Flux (Nokorod—acid) (Muriatic):
   1. Keep away from all other chemicals. In case of breakage the acids should be flushed—neutralized with sodium carbonate.
   2. Keep well bottled with tight fitting cover and in a safe place.
   3. Use flux sparingly on all points.
   4. Be especially careful not to get flux on hands or body.
   5. In cutting muriatic acid with zinc use earthen container or glass jar.

d. Furnaces:
   1. Be sure all fittings are tight.
   2. In lighting—first light match, then turn on gas.
   3. Be absolutely certain that gas is turned off when finished.
   4. Keep hands clear of furnace.
   5. Avoid overcrowding near furnaces.

e. Soldering Copper:
   1. Keep in certain, definite place when not in use.
   2. Keep hands away.
   3. Keep hands well cleaned.
   4. Watch out for falling (hot) solder.
   5. Never test with hands.
   6. Do not carry around in shop.

[9]Many of the general safety recommendations also apply to the sheet metal as well. All of these recommendations appear in *Safety Standards and Recommendations for School Shops.* School District of Lancaster, 1934.

f. Electric Soldering Copper:
   1. Snap switch carefully when not in use and when finished.
   2. Keep close check on cord and watch for torn insulation and breaks.
   3. Always disconnect for repairs, etc.

g. Tinplate, Gal. Iron, Bl. Iron, Wire, Zinc, Copper:
   1. Carefulness in handling cannot be overemphasized.
   2. Although injuries are usually small cuts they may nevertheless result seriously. Over ninety percent of the sheet metal accidents are the result of the careless handling of these supplies.
   3. Edges and corners are very sharp and one's whole attention should be toward the careful handling of these materials.
   4. Watch out for your fellow workman also, lest you should injure him unintentionally in going about your own job.
   5. In cutting tin be very careful to eliminate all sliver edges or ragged edges.

Woodworking[10]

a. Band Saw:
   1. Determine the proper cutting procedure and mark with numbered pencil lines before turning on the power.
   2. Make all necessary adjustments before starting the saw. Keep the upper guide as close to the stock as convenient.
   3. Do not start the cut until the saw has come up to maximum speed, or cut after the power has been shut off.
   4. All turns must be made gradually, sudden short twists might cause the saw to break.
   5. Never attempt to back out for any great distance. You might pull the blade off the wheels.
   6. See your way out before beginning the cut. If backing out is necessary STOP THE MACHINE.
   7. When small pieces catch in the table throat, STOP THE MACHINE and notify the instructor.
   8. Push scraps away from the table with a stick.
   9. Never reach back of saw to pull the material through.
   10. Cylindrical stock must never be cut on the band saw. It tends to roll and will break the blade or throw the fingers into the saw.
   11. Pupils must not stand at right side of band saw. If the blade should break a serious accident may occur.
   12. Learn to cultivate finger tip control of the stock.
   13. Tilting the table, or other special set-ups, may be used by special permission only.
   14. Do not tamper with upper wheel tilting device.

[10]Many of the general safety recommendations also apply to woodworking as well. All of these recommendations appear in *Safety Standards and Recommendations for School Shops*. School District of Lancaster, 1934.

b. Tool Grinder:

1. Goggles must be worn by emery wheel operators.
2. Grinding fiber, wood, brass, etc., damages the cutting properties of the wheels and is absolutely forbidden.
3. Steel slivers should be removed at once and FIRST AID applied.
4. Do not hold materials to be ground with pliers. Use a safety holding clamp.
5. Never force so hard as to burn the edge of the tool.
6. Wood cutting tools are ground on the oil wheels, not on the emery stone.
7. Do not tamper with the wheel guard or the grinding rest.
8. Prevent tools from slipping down between the wheel face and the wheel guard. Tools may catch and break the stone.

c. Jointer:

1. The guard must always be in place and in functioning condition.
2. The pupil shall make no adjustments except under the immediate supervision of the instructor.
3. Watch out for knots and split stock.
4. The stock must be twelve inches or more in length.
5. Always use a pusher for surface jointing.
6. Joint no piece under one inch in width or thickness.
7. END GRAIN may never be run over the jointer.
8. Do not start the cut until the machine has come up to maximum speed, or cut after the power has been turned off.
9. Keep fingers as high as possible on the stock and never drag the thumb at back of board.
10. Do not work against the grain or force the cut too hard.
11. Follow through with the stock and allow the guard to return to the normal closed position.
12. When the fence is moved away from the extreme right side some guard protection must be installed to cover the exposed blades.
13. When blades are installed double check for security before turning on the power.
14. "Kick backs" occur on the jointer when the first table is lowered and the cut is too heavy, also when hard knots are struck.

d. Wood Lathe:

1. Ask the instructor for the proper speed for each job.
2. Be sure glued work is properly set and solid.
3. All tools must be kept sharp for good safe accurate work With sharp tools little force will be necessary.

4. Never use the gouge for inside turning.
5. Examine wood for dangerous knots, checks and splits.
6. Fasten the work securely and check all adjustments.
7. Keep the rest close to the work, stopping frequently to mak follow up and adjustment.
8. Hold the tool firmly in BOTH hands.
9. Stop the lathe for calipering and measuring unless the piec is absolutely round.
10. Do not shut off face platejobs too quickly, they may bac off the spindle.
11. Do not slow down the machine by grasping the work broken fingers have resulted.
12. Beware of polishing rags. The loose ends may catch in th work and be wound up, with serious results.

c. Circular Saw:

1. The saw guard must always be in place in functioning con dition. It should never be necessary to remove the guar for any operations; find another way to secure the sam results without exposing the pupil to danger.
2. Make all adjustments to machine with the power turned of
3. Use the ripsaw to cut with the grain and the cross cut acros the grain. A combination saw may be used for all cuts i soft woods up to three-fourths of an inch in thickness.
4. Use the ripping fence with the grain and the cross cut gaug across the grain ONLY.
5. Be sure to use the right hand cross cut gauge in the rig hand slot and vice versa.
6. Do not raise the saw too high—just so it comes throug the wood about one half inch.
7. A stop block must be used for cutting off lengths, so th several inches of clearance allow the cut off pieces to removed. Never cut off by stopping against the rippi fence.
8. Ripping without the ripping fence and crosscutting wit out the crosscut gauge is absolutely forbidden.
9. When ripping, a spreader shall be attached at the rear the saw table to prevent the stock from binding and the fore being repulsed against the operator.
10. The saw guard shall remain in contact with the mater being cut except where the surface might be marred, which case the guard may be raised SLIGHTLY.
11. A push stick is necessary to feed narrow stock between t saw and the ripping fence.
12. Remove scraps from the saw table with a long stick wood.
13. When helping to "tail off" never pull on the wood, just su port it and allow the operator to feed and guide the sto

14. All setups, other than straight work, must be checked and approved by the instructor.
15. Careful of "kick backs" and see that others are never standing, or working, directly in line back of the saw.
16. Dado heads are dangerous in that a wider tearing surface is exposed. Extra precautions are necessary to prevent the stock from "riding" back over the saw.
17. Any saw that "wabbles" is dangerous and must not be used.

f. Surface Planer:

1. Be sure to measure the stock accurately before setting the bed for the first cut.
2. Do not plane under one-fourth inch in thickness. Even a support board is dangerous for planing thin pieces.
3. Stock less than twelve inches in length shall not be run through the thickness planer.
4. Edge planing, where tilting cannot be prevented, is prohibited.
5. Keep hands away from feed rolls and chip escape.
6. When blades are installed, double check for security before the power is turned on.
7. "Kick backs" occur on the planer only when the stock is smaller than the feed roll opening and the board is stuck directly against the revolving cutter head.

Procedure in Case of Accident

Each school district will want to set up its own procedure to be ollowed in the event of an accident. The city schools of Detroit ıave set up the following procedure in the case of a serious accident:

1. Give first aid to the injured.
2. Call Receiving Hospital, Cadillac 7305, and arrange to transport the patient to competent medical aid, either by the Receiving Hospital Ambulance, or, in the case of less serious accidents, by the car of a principal or instructor. Receiving Hospital is located at 1300 St. Antoine Street.
3. Notify the child's parents of the accident either by phone or in person and state where the injured has been taken.
4. If the parents desire to arrange for medical care at some place other than the Receiving Hospital, inform them that IT WILL BE AT THEIR OWN EXPENSE AND LET THEM MAKE THEIR OWN ARRANGEMENTS FOR THE TRANSFER.
5. Notify the School District Safety Engineer by phone immediately.
6. Take every precaution to insure that all machinery, equipment, etc., is left untouched until inspected by the Safety Engineer.

The vocational department of the city schools of Williamsport ssue instructions to teachers printed on the outside of an envelope. he instructions follow:

This envelope contains:

School accident report blanks in triplicate.
Stamped and addressed envelopes of report to Superintende
Emergency bandage for serious injury.

1. Report every accident in which the skin is broken, and send i report IMMEDIATELY.
2. Apply at office for additional reports, envelopes, and bandag before your present supply is exhausted.
3. Accidents are NOT to be treated by shop teachers.
4. In all cases of reported accidents, the student should be sent t the school office for treatment, unless in the opinion of the sho teacher, or office secretary, immediate surgical aid is require
5. In such serious accidents, the shop teacher, or office secretar should take or send the student to the Williamsport Hospit Emergency Ward, or to the family physician.
6. The emergency bandage is for the purpose of stopping exce sive bleeding until surgical aid is obtained, and is not to b used for slight cuts. This emergency bandage is aseptic, and sealed to prevent the entrance of foreign substances. Do no open until needed, and destroy unused portion. Read the dire tions on the bandage.
7. The school district is not to be held responsible for the pay ment of hospital and doctor bills. These bills should be sent t the parents.
8. I have read the above instructions and understand them.

.....
Signature of teacher

The report form[11] used in this study may be used by districts reporting accident injuries. During the next few years attemp should be made to have a unified accident reporting system.

First Aid[12]

EQUIPMENT:

Each shop or group of shops should be equipped with First A Cabinets used exclusively as containers for all First Aid materia These supplies should be kept meticulously clean and free from du

Each cabinet should contain:

1 bottle of aromatic spirits of ammonia
1 roll of absorbent cotton
1 spool of adhesive tape
1 roll of 2-inch bandage
1 jar of vaseline
1 bottle of mercurichrome

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[11]See form on pages 23 to 26 inclusive.
[12]Instruction regarding "First Aid to the Injured" may be found in National Society for Study of Education, "The Present Status of Safety Education." *Part I, Twenty-fifth Yearbo* Bloomington: Public School Publishing Company, 1926, p. 47.

NSTRUCTION IN FIRST AID:

The nurse, teacher, safety engineer or member of a First Aid team hould be well informed regarding administering First Aid to the njured. They need to remember that First Aid is an emergency reatment only. This service is rendered to the injured to reduce the anger until competent medical care can be provided. Seek the aid f experts as Doctor, Nurse, etc., as soon as possible following an ccident.

In case of cuts, it is usually wise to bandage wounds temporarily ntil the assistance of a Physician can be secured. Or if unduly de-ayed flush the dirt out of a wound. Use gauze or clean handkerchief o stop excessive bleeding.

In each school and shop, persons should be designated as being esponsible for administering First Aid in case of an emergency.

Keeping Accident Records

A very large number of the accident studies and, in fact, most of ne safety literature, states that keeping accident records forms the asis of safety work.

Each school district could set up its own plan for keeping accident ecords. The safety movement could be further advanced if there ould be an agreement regarding the method of keeping accident ecords in all school systems. It is proposed that Chapter V, "The indings of this Study," be used as a basis for trying out a unified ecord system, pending corrections, improvement, and final adoption a better method.

Every district should keep continuous record of all accident in-ries for study and comparison within the school system. Later hool systems will want to compare their success in eliminating cidents with others. This may well be fostered through conven-on program discussions. Later a state-wide unified system will be anted to meet the situation more adequately.

An honest basis of comparison will require the establishing of rtain units of measurement not generally familiar to industrial achers as yet. In industry **frequency rate** and **severity rate** are used index terms for comparison. These terms have the following eaning in industry:

FREQUENCY RATE = Lost time accidents per million man urs worked.

SEVERITY RATE = Number of days lost per thousand man urs worked.

In school shops these same terms could be interpreted thus:

FREQUENCY RATE = The number of accidents per million sident hours exposed.

SEVERITY RATE = The number of hours lost per thousand sident hours exposed.

There are relatively few accident injuries necessitating days lost. he days lost could be multiplied by the number of hours in a school dy and thus reduce all lost time to an hourly basis.

Severity of injury could well be divided into the following he
ings:

COMMON—Did not require first aid.
MINOR—Required first aid treatment only.
SEVERE—Medical aid, stitches or setting bones, etc.
SERIOUS—Lost use of a member of the body.
CRITICAL—May cause death.
DEATH—Accident resulted in death.

In any accident record system is it important that forms used
collecting the data are simple, clear, and tend toward a proper
porting of the situation.

As an illustration, a case was reported where the cause of the a
dent was given as **carelessness.** The description of the accident ir
cated the boy was **leaning on machine.** A further study shortly a
revealed that the young man had worked until 3 A.M. the night
fore the accident. **Lack of proper rest** might have been a more c
rect cause.

Safety Organization

In several large cities, notably Pittsburgh, Williamsport, and
troit, plans for carrying on safety programs in the school shops
for the appointment of a student in each class to be in charge
safety for the time the class is in shop. This is in line with the sch
boy patrol plan which is functioning successfully on the schoolgrou
and at street crossings.

An attempt is made in these school systems, to give as larg
number of boys as possible the experience of being in charge
safety. In some few schools the students in charge of safety se
for a week or a month. Student safety engineers hold safety meeti
to discuss their common safety problems.

Duties of the Safety Engineer[13]

1. See that all neckties are removed or tucked in.
2. See that sleeves are rolled up.
3. See that aprons are worn, whenever possible.
4. See that goggles are worn at the grinder.
5. See that goggles are worn at the furnace when molten me
is being poured.
6. Keep all flames inside the furnaces.
7. Supervise lighting the furnace.
8. Set the toolrest on the grinder.
9. See that tools are kept off the floor.
10. See that oil is wiped off the floor.
11. See that oily rags are placed in the covered metal contai
12. See that there are no mushroomed tools used.
13. See that no files are used without handles.

[13]This list of duties is reprinted from *Safety Education in the School Shop*, Bulletin No.
which was prepared by Mr. Hugh McKinnon, machine-shop instructor, Miller Interme
School, Detroit, and Mr. Gordon Graham, safety engineer, Detroit Board of Education.

14. Inspect the first-aid cabinet.
15. See that all cuts are properly dressed.
16. Prevent "horseplay" in the shop.
17. See that finger rings are removed.
18. See that the crib boy does not give out any defective tools.
19. See that no safety guards are removed from machines.
20. See that no pieces of hot steel are left lying about unmarked.
21. See that a machine operator does not walk away from his machine while it is running.
22. See that belts on the countershaft are shifted with the belt stick.
23. See that lathes are stopped before shifting the belts on the spindle cones.
24. See that no rags are used around the machine while the main power switch is on.
25. See that work on the drill press is held in a vise or firmly clamped.
26. See that boys do not stand directly in front of the grinding wheel.
27. See that every machine is released before throwing on the main power switch.
28. Report any infractions of the "Safety Rules and Regulations," or any other unsafe practices that come to his attention.
29. Report all accidents to the instructor and make out accident reports to be handed to the instructor.
30. In his notebook, the safety engineer shall tell each day what he did to prevent accidents.

Check lists containing duties of the safety engineer are used effectively in a number of schools.

Safety Pledge

The Pennsylvania Department of Labor and Industry in 1929 conducted a state-wide safety campaign. In this campaign the safety pledge was used with satisfaction to all concerned. Many of the students in the school shops signed these safety pledges.

SAFETY ALWAYS

I PLEDGE MYSELF TO DO MY BEST IN PENNSYLVANIA'S SAFETY CAMPAIGN TO BE RESPONSIBLE FOR NO ACCIDENTS TO MYSELF OR TO ANYONE SO THAT LIFE MAY BE HAPPIER AND LABOR MORE PROFITABLE FOR ME AND MY FELLOWMEN.

.....

Commonwealth of Pennsylvania
Department of Labor and Industry

First Aid Team

Industry has found the formation of First Aid teams most s cessful. Keen interest and friendly competition has been crea between teams in training when they demonstrate their abilities "Safety Meets."

Local industries would gladly cooperate with the schools in training of First Aid teams for the school shops.

These teams should be so organized that boys would be trai and available to conduct first aid work in each school shop.

This instruction should cover bandaging for cuts, fractures, bur shock and asphyxiation.

Best Record Trophy

It would be well for schools to arrange for the awarding o trophy to the group of students maintaining the Best Safety Rec Probably some industry or organization in the community mi furnish the trophy to be awarded.

Students in art metal or sheet metal might also make the trop

If trophies are not available or considered desirable, then so public acknowledgment should be made in assembly or bulle board. This will tend to motivate the safety program.

Safety Instruction

Subject-matter. There is such a wealth of safety material availa as may be seen by reviewing the "Selected Bibliography." The l three chapters in this study furnish the basis for suitable subje matter. Subject-matter outlines appear in any magazine issues a also in books dealing with safety.

Method of Teaching Safety. Safety should be taught from a po tive approach pointing out first the right way of doing things a stressing this point. Dangers should also be pointed out so that s dents are aware of hazards and results from wrong ways of wo

There are those who believe all safety should be taught as rela class work and definite time should be scheduled for safety instr tion. There are others who believe all school shop safety should taught by the teacher in the shop. The shop and the related-subje teachers both have their contribution to make and undoubte should participate in safety instruction. Many subjects lend the selves to the teaching of safety and all should be utilized. A coordi tion of this instruction can be worked out between shop and rela subjects teachers.

The demonstration method is commonly used by shop teach A number of the larger school districts have found it profitable stage safety demonstration lessons at teachers' gatherings as a me of improving methods of teaching safety.

A student safety organization can be made an effective means checking up and improving safety practices. A good time to teac subject is when the students are conscious of the need. Thus saf should be taught just before the students need to know or as n as possible to the time when they need to know.

Posters, lectures, slides, films, and demonstrations have all b used effectively to teach safety. Recently schools are insisting

safety tests with one hundred per cent as the passing grade. The following is an illustration of one of a number of different safety tests used in Lancaster Public Schools:

SAFETY TEST IN WOOD WORKING
THE JOINTER

No pupil will be allowed to operate The Jointer until he has passed the machine operator's test in jointer operation and has made a score of one hundred percent.

Name..... School.....
Score.....% Date..... Class.....

Has parent's permission card been received?.....
1. Machines should not be ..... in the absence of the instructor
2. .... may never be run over the jointer.
3. Inspect lumber for .... before jointing.
4. Always use a ..... for surface joining.
5. Stock must be over ..... inches in width, and ..... inches in length for safe joining.
6. All jointer adjustments will be made by.....
7. Do not ..... until the jointer has reached ..... speed.
8. When leaving a machine .... the .....

Summary

The known tested satisfactory methods of dealing with safety should be employed until better methods have been discovered. Everyone concerned ought to study safety hazards with a view of providing improvement in practice.

Dangers and hazards must be pointed out to students in order that they may protect themselves from the same.

Safety should be taught from a positive approach—or the right way of doing things should be stressed.

Teachers and students should be informed and trained in what to do in case of an accident.

School shops should be equipped with a complete sanitary safety cabinet.

Records of accidents should be carefully prepared and then tabulated as a basis for future safety study.

Student safety engineer organization is advocated for all school shops.

Both shop and related subject teachers should cooperate in teaching safety.

To provide the next generation with safe-workers in industry, we must train students in school shops to work and think safety. This will mean that teachers will need to teach and practice safety.

Directors of industrial education will need to lead in setting up and administering an effective safety program.

Those engaged in teacher-preparation have an opportunity and a responsibility to lead all others in safety education resulting ultimately in producing safe workers all along the line.

Let us all unite in eliminating accidents and in producing workers with a positive safety attitude.

The best known safety device is a careful worker.

Selected Bibliography

BOOKS

Alexander, Magnus W. *A Review of the Safety Movement.* Chicago, National Sa Council Proceedings, 1924, pp. 954-961.

Ashe, C. W. *Organization in Accident Prevention.* New York: McGraw-Hill B Company, 1917.

Beard, H. E. *Safety First for School and Home.* New York: MacMillan Compa 1924.

Beyer, D. S. *Industrial Accident Prevention.* New York: Houghton Mifflin Compa 1920.

Bingham, W. V., and Slocombe, C. S. *Men Who Have Accidents.* New York: I sonnel Research Federation, 1927.

Cowee, G. S. *Practical Safety Methods and Devices.* New York: D. Van Nostr Company, 1916.

DeBlois, L. A. *Industrial Safety Organization.* New York: McGraw-Hill Book C pany, 1926.

Eastman, C. *Work Accidents and the Law.* Russell Sage Foundation, 1910.

Fisher, B. *Mental Causes of Accidents.* New York: Houghton Mifflin Company, 1

Frankel, L. K. and Fleisher, A. *Human Factor in Industry.* New York: MacMi Company, 1920.

Gilbreth, F. B. and L. E. *Fatigue Study.* New York: Sturgis and Walton, 1916.

Heinrich, H. W. *Industrial Accident Prevention.* New York: McGraw-Hill B Company, 1931.

Henig, Max S. *Safety Education in the Vocational School.* New York: National reau of Casualty and Surety Underwriters, 1928.

National Society for the Study of Education. "The Present Status of Safety Educati *Part I, Twenty-fifth Yearbook.* Bloomington: Public School Publishing Compa 1926.

Payne, E. G. *Education in Accident Prevention.* New York: Lyons and Carnal 1922.

Payne, E. G. and Shroeder, L. C. *Health and Safety in the New Curriculum.* N York: American Viewpoint Society, Inc., 1925.

Resnick L. and Carris, L. H. *Eye Hazards in Industrial Occupations.* New Y National Committee for the Prevention of Blindness, Inc., 1924.

Safety Institute of America. *Safety Fundamentals.* New York: Safety Institute America, 1920.

Schereschersky, J. W. "Industrial Hygiene." *Reprint No. 302.* United States Pu Health Service, 1915.

Schwedtman, F. C. and Emery, J. A. *Accident Prevention and Relief.* National A ciation of Manufacturers of the United States, 1911.

Tolman, W. H. *Manual of Safety.* New York: American Institute of Safety, 1912

Tolman, W. H. and Kendall, L. B. *Safety Methods for Preventing Occupational Other Accidents and Diseases.* Harper Brothers, 1913.

Williams, S. J. *The Manual of Industrial Safety.* New York: McGraw-Hill B Company, 1927.

BULLETINS

City Schools

"Handbook of Safety Regulations," *Bulletin of Board of Education,* City of De (1933).

"Industrial Safety Programs," *Bulletin of the Public Trade Schools,* Pittsburgh (19

"Safety Standards and Recommendations for School Shops," *Bulletin of City Sch of Lancaster* (1934).

"Safety Standards and Recommendations for Use of Teachers of Shopwork," *Bul of City Schools of Philadelphia* (1930).

"Training for Industry," *Bulletin of City Schools of Williamsport* (1931), 21-2.

Federal Board for Vocational Education

"Industrial Accidents and Their Prevention," *Bulletin No. 47.* 1919.

"Training Courses in Safety and Hygiene in the Building Trades," *Bulletin No* 1919.

Pennsylvania Department of Labor and Industry[1]

'Abrasive and Polishing Wheels."
'Affecting Employment of Minors."
'Affecting Employment of Women."
'Bakeries."
'Boilers."
'Canneries."
'Compressed Air Apparatus."
'Construction and Repairs."
'Cranes and Hoists."
'Dry Color Industry."
'Elevators, Escalators, Dumbwaiters and Hoists."
'Electric Safety."
'Foundries."
'Grandstands."
Head and Eye Protection."
Industrial Home Work."
Industrial Lighting."
Industrial Sanitation."
Labor Camps."
Ladders."
Laundries."
Lead Corroding and Lead Oxidizing."
Logging, Sawmill, Woodworking, Veneer and Cooperage Operations."
Machine Tools."
Mechanical Power Transmission Apparatus."
Miscellaneous Hazards and Conditions of Employment."
Plant Railways."
Power, Foot and Hand Cold Metal Presses."
Printing and Allied Industries."

rotection from Fire and Panic
"Class I Buildings"
"Class II Buildings"
"Class III Buildings"
"Class IV Buildings"
"Fireproofing"
"Construction, Installation and Maintenance of Emergency Lighting Systems"
"Construction, Installation and Operation of Fire Alarm Systems"
"Operation of Motion Picture Projectors"
"Storage and Handling of Photographic and X-ray Mitrocellulose Film"
"Specifications for Standard Fire Escapes"

Railings, Toe Boards, Open-sided Floors, Platforms and Runways."
Safe Practice Recommendations."
Spray Coating."
Stationary Engines."
Textile Industries."
Trenches and Excavations."
Tunnel Construction and Work in Compressed Air."
Window Cleaning."

National Safety Council[2]

Artificial Respiration, Prone Pressure Method."
Bibliography—Accident Prevention—Health and Hygiene."
Buyer's Guide of Safety Equipment."
The Healthy Worker."
Help Prevent Fires and Accidents."
Helping Industry in Health Work."
Industrial Safety Program to Fit Your Needs."

[1]Department of Labor and Industry, Harrisburg, Pa.
[2]National Safety Council, 20 N. Wacker Drive, Chicago, Illinois.

"Motion Picture Film List."
"Positive versus Negative Instruction."
"Posters—Safety"—*Annual Catalog.*
"Psychology and Safety."
"Safety-Aid."
"The Safe Driver."
"Safe Worker."
"Safety Education in the Vocational School."
"Safety Poems."
"Safety Slogans."
"The Safety Speaker."
"Shop Safety."
Fire Prevention School
"Fire Extinguishing"
"Fire Prevention—Special Hazards"
"Fire Prevention—General Hazards"
Home Safety Lessons
"House We Live In"
"Outguessing the Child"
"Electricity and Gas—Their Use and Abuse"
"Flaming America"
"When Accidents Occur"
"Accidents a Community Problem"

You and Your Car
"Rules of the Road"
"Mechanical Equipment"
"The Motorist and the Pedestrian"
"Automobiles and Railroads"
"Garage Accident Hazards"
"Safe and Efficient Driving"

Safe Practices Pamphlets
"Acids and Caustics," *Bulletin No.* 25
"Belt Shifters and Belt Slippers," *Bulletin No.* 5
"Belts and Belt Guards," *Bulletin No.* 7
"Caring for Injured Workers," *Bulletin No.* 82
"Construction of Machinery Guards," *Bulletin No.* 58
"Electrical Equipment in Industrial Plants," *Bulletin No.* 29
"Engine Guarding and Engine Stops," *Bulletin No.* 9
"Exhaust Systems," *Bulletin No.* 32
"Fire Causes and Prevention," *Bulletin No.* 31
"Fire Extinguishment," *Bulletin No.* 24
"Floors and Flooring," *Bulletin No.* 11
"Gas and Electric Welding," *Bulletin No.* 23
"Goggles," *Bulletin No.* 14
"Grinding Wheels," *Bulletin No.* 13
"Hand Tools," *Bulletin No.* 41
"Hoisting Apparatus," *Bulletin No.* 33
"Industrial Accident Statistics—How to Collect and Tabulate Them," *Bulletin N* 21
"Industrial Housekeeping," *Bulletin No.* 45
"Knots, Bends, Hitchens and Slings," *Bulletin No.* 6
"Ladders," *Bulletin No.* 1
"Machine Shop Machinery," *Bulletin No.* 39
"Maintenance and Repair Men," *Bulletin No.* 70
"Motion Pictures in Educational Work," *Bulletin No.* 62
"Oiling Devices and Oilers," *Bulletin No.* 10
"Power Presses," *Bulletin No.* 18
"Protective Clothing," *Bulletin No.* 16
"Safe Practices in Forging and Hot Metal Stamping," *Bulletin No.* 85
"Scaffolds," *Bulletin No.* 12
"Shafting, Couplings, Pulleys, Gears, Sprockets and Chains," *Bulletin No.* 8
"Stairs and Stairways," *Bulletin No.* 2

"Teaching Safety to New Employees," *Bulletin No.* 65
"Training for First Aid," *Bulletin No.* 83
"Warning Signs—Their Use and Maintenance," *Bulletin No.* 81
"Woodworking Machinery and Equipment," *Bulletin No.* 20

United States Department of Labor

"Accidents and Accident Prevention in Machine Building," *Bulletin No.* 256
"Industrial Accidents to Men and Women," *Bulletin No.* 81
"Occupation Hazards and Diagnostic Signs," *Bulletin No.* 306
"Record of Industrial Accidents in U. S. to 1925," *Bulletin No.* 425
"Standardization of Industrial Accident Statistics," *Bulletin No.* 276
"Statistics of Industrial Accidents in U. S. to End of 1927," *Bulletin No.* 490

The National Safety Council publishes a large list of pamphlets on Safety. Only a few of their publications applying most directly are listed here. Insurance companies and the large industrial concerns quite generally publish Safety pamphlets.